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REVIEW OF THE WORK OF THE ROYAL BOTANIC GARDENS, KEW, DURING 1951

General

The Worshipful Company of Gardeners has elected the Director to the very small and distinguished company of those who are Honorary Freemen of the Company and he was admitted at the Livery Meeting on November 19th.

The Director was invited to deliver a Public Lecture at the British Association Meeting in Edinburgh on August 13th. His subject was "The Contemplative Gardener". The chair was occupied by Sir William Wright-Smith.

The Director was reappointed Vice-President of the Royal Society by Professor E. D. Adrian, O.M., P.R.S.

As Fullerton Professor of the Royal Institution, the Director delivered a Friday Evening Discourse on May 18th, on the West Australian Flora which had a special significance in view of the Jubilee of the Australian State and the year of the completion of a special house at Kew which the Director had obtained for housing Australian species, particularly of this region.

In February, the Director delivered a course of three lectures to students at the Royal Institution on the subject of the British Weed Flora.

Dr. W. B. Turrill, the last year's president and vice-president for 1951 of Section K, British Associatio for the Advancement of Science, attended the Edinburgh meeti and gave a paper on "Wild and Cultivated Olives."

Dr. W. B. Turrill served as pre ent of the British Ecological Society for his second year and took as the subject for his presidential address delivered at University College, London, on 6th January, "Some Problems of Plant Range and Distribution."

A Memorial to the men of Kew Gardens staff who fell in the last World War was presented to the Royal Botanic Gardens by the Kew Guild. This has been placed beneath the memorial to those who fell in the First World War. The Memorial was unveiled by the Director on Remembrance Sunday and was dedicated by the Right Reverend Bishop Deane.

Visitors

The number of visitors to the Gardens in 1951 was 1,205,957. Weekdays, 681,885 and Sundays 524,072. (The total decrease of attendances compared with 1950 was 274,923). The greatest monthly attendance was in June, with 218,885, and the lowest in December, with 11,518. The highest weekday attendance was Whit Monday, 14th May—29,670, and the highest Sunday attendance, 3rd June, when 38,274 people passed through the turnstiles. The lowest attendance of all was on the 8th November, when 17 people entered the grounds. The decrease in comparison with previous years is probably to be attributed to the counter attraction of the Festival of Britain, and even more to the wet weather. It should be noted that on the 1st April, 1951, the charge of 1d. for admission was increased to 3d.

The Herbarium

The amount of routine work carried out in the Herbarium during the year is indicated in part by the following figures :—

Specimens received for the Herbarium, 77,851 ; specimens received on loan, 4,718 ; specimens sent on loan, 6,247 ; specimens distributed as duplicates 11,101 ; sheets mounted, 45,606 (excluding Fungi and Bryophyta).

In most departments, laying-in has approximately kept up with the number of sheets mounted.

Visits paid to the Herbarium and Library by botanists numbered 4,269. This figure does not include the 415 visitors on the 4th and 5th May when special exhibits illustrative of the work of Kew were demonstrated to students, teachers, members of scientific societies and others specially invited by the Director. A large number of overseas botanists worked in the Herbarium often for extended periods during 1951.

Members of the scientific staff continue to be indebted to Mr. W. C. Worsdell for assistance in the translation of papers from various foreign languages—Miss M. M. Whiting has again given valuable voluntary service in re-arranging material from India and Malaya. Miss S. Wilson assisted with the laying-in of drawings. Dr. J. Hutchinson has worked in the Herbarium and Library, especially on the genera of flowering plants.

During the year a total of 2,353 enquiries and plant consignments has been dealt with.

Europe, Orient and N. Africa. In addition to the routine work of replying to the many individual queries received during the course of the year, the following major tasks have been undertaken or concluded.

Mr. R. A. Blakelock's work on E. R. Guest's collections from Iraq has been completed, accounts of all the dicotyledons represented in the collection have been published ; work on a large collection of plants from Iraq forwarded by the Field Museum, Chicago, is almost finished, and a collection made by Mrs. E. Chapman in Cyprus and Syria has been named. Mr. Blakelock has also published an account of *Euonymus*, dealing with the history, geographical distribution, phylogeny, economics etc., of the genus. Keys to the sections, series and 176 species are included.

Miss P. Lewis, assisted by Mr. B. L. Burtt, continued her work on the Kuweit plants collected by Mrs. H. R. P. Dickson, and a further part of the Flora is now ready for publication. In addition, Miss Lewis has finished naming the valuable collection of Arabian plants presented to Kew by Mr. A. C. Trott.

Mr. R. D. Meikle, in charge of the European department since Mr. B. L. Burtt's transfer to Edinburgh, is preparing an account of the flora of Chios, based on the extensive collectings made on the island in 1939-40 by Major Platt ; work on this collection was postponed owing to the war.

Miss I. Blewett, assistant to the department, has recently rearranged all the European and Oriental material of *Verbascum* to follow Murbeck's monograph of the genus, and is preparing an index to the Kew collections. Such rearrangements and indexing are to be carried out wherever an up-to-date revision or monograph is available.

Valuable collections have been received during the year from Mr. P. H. Davis (Near East), Mr. F. Merton (Cyprus), Dr. H. F. Mooney (Palestine and Iraq), Prof. Rechinger (Persia), and Miss R. de Sausmarez (Bulgaria) ; individual specimens of special interest are the original gatherings of *Diapensia lapponica*, a northern plant recently found in Scotland by Mr. C. F. Tebbutt, and of *Dactylis polygama* (*D. aschersoniana*) recognized and collected by Mr. C. E. Hubbard. Additional material of a recent re-discovery, *Homogyne alpina*, has been communicated by Mr. B. W. Ribbons.

Northern Asia, China, Japan, and northern India. The collections from the Hongkong Herbarium, which, as reported last year, were presented to Kew, are being examined systematically, and collectings not represented here are being extracted, mounted and incorporated.

Two collections of named plants have been mounted and incorporated, namely a set of Kashmir specimens collected by Dr. R. R. Stewart and presented by the New York Botanic Garden, and 200 Japanese specimens presented by the Tokyo Science Museum.

Mr. F. C. Greatrex, for many years H.M. Consul at Nagasaki, has presented his herbarium of Japanese plants (all named), comprising upwards of 2,500 numbers. Many of the specimens are small or incomplete, but the majority will form a welcome addition to the Kew collections, especially those representing species described by Japanese botanists during the past 20–30 years.

Dr. E. K. Janaki Ammal has presented a set of the plants she has collected chiefly in India and Nepal, and also material of cultivated plants whose chromosome numbers she has determined. Dr. Janaki spent a short time at Kew sorting and labelling the material.

S/Sgt. G. Moorcroft, who is serving with the United Nations forces in Korea has sent in 220 packets of seeds of Korean plants. Those of trees and shrubs, 24 packets, have been passed to the Arboretum, and 8 packets of bulbous plants have been sent to the Herbaceous department. The remainder have been, or will be, sown in the Herbarium Experimental Ground.

The large number of east Asian species cultivated in the British Isles

leads to numerous enquiries concerning them, and a considerable amount of time has been absorbed by this work. The specimens sent in often form useful additions to the collections, and during the past year a large number of cultivated specimens—including those used for the Botanical Magazine—have been dried, mounted, and laid in. Work on cultivated plants in some large genera is greatly facilitated if the cultivated material in the Herbarium is separated from the wild material and arranged by itself. During the past year this separation has been effected for *Rhododendron*, *Rubus*, *Sorbus*, and *Cotoneaster*.

Work has continued, whenever possible, on the revision of *Camellia* ; considerable progress has been made with the preparation of the ms. for publication.

Malaysia. As noted in last year's report, Mr. F. N. Hepper, who joined the staff as Scientific Officer in August, 1950, was called up for National Service in December of that year, after only four months in the Herbarium. In March, 1951, Mr. L. L. Forman, B.Sc., was appointed to fill Mr. Hepper's place during the latter's 2 year absence. Considerable progress was made with the naming of the material received from the North Borneo Forest Department, and arising out of this an investigation was commenced into the affinities of a small group of Anacardiaceous genera, including *Spondias*, *Allospondias*, and *Solenocarpus*, completion of which awaits the receipt of more ample material.

It is satisfactory to be able to report the resumption and completion of the revision of the *Thymelaeaceae–Gonystyloideae* for the *Flora Malesiana* ; the ms. was dispatched at the beginning of December, 1951. Work on the revision of the *Pentaphragmataceae* for the same undertaking is now in progress.

Mr. Kasin Suvatabandhu, of the Department of Agriculture, Thailand, worked in the Herbarium during the earlier part of the year and named the greater part of the Kew set of the collection made by the Dutch Expedition to the Kwae Noi River Basin, Thailand, in 1946.

The mounting of the large named collection received from Singapore in 1947 has progressed steadily, about 3,000 sheets having been dealt with. An unnamed collection received from Trinity College, Dublin, of about 500 specimens collected by Perrottet and others in S. India over a century ago, has been mounted and incorporated, but not fully named.

Tropical Africa. Routine work during the year has been concentrated on naming collections from East Africa. The last of the war-time accumulations, namely the extensive collections made by Mr. P. R. O. Bally and others mainly in Kenya, is now in process of determination. Many excellent collections from East Africa received during the year are also being named and incorporated as quickly as possible. Work on collections from other areas has in consequence not been great.

Among those who have made collections and presented them to Kew during the year may be mentioned F. C. Deighton, P. Adames, H. D. Jordan, T. S. Jones, R. R. Glanville, D. Small (Sierra Leone), J. G. Andoh, K. Obeng Darko (Gold Coast), R. W. J. Keay (Nigeria and British Cameroons), A. S. Boughey (Fernando Po), J. K. Jackson (A.-E. Sudan), J. W. Purseglove, H. C. Dawkins (Uganda), B. Verdcourt, P. J. Greenway, R. W. Rayner, P. R. O. Bally, A. V. Bogdan (Kenya),

W. J. Eggeling, H. G. Faulkner (Tanganyika), G. Jackson (Nyasaland), H. J. A. Rae (Northern Rhodesia), H. Wild (Southern Rhodesia) and O. B. Miller (Bechuanaland Protectorate). Smaller but equally useful collections, many of a high standard, have also been received, but space will not allow mention of their collectors' names. Our thanks are due to all these collectors for the help they have given us.

Again many valuable specimens have been received in exchange from the Jardin Botanique, Brussels, the Centro de Botanico da Junta de Investigaçôes Coloniais, Lisbon, the Instituto Botanico della Universitá, Florence, the National Herbarium, Pretoria and the Missouri Botanic Garden.

Mr. A. A. Bullock returned from Africa in September, and his fine collection from S. W. Tanganyika and N. E. Northern Rhodesia will no doubt add much to our knowledge of the floras of these regions. The collection, which includes some 2,500 gatherings, has been sorted into families, and work on naming it will start early in the New Year.

The printing of the "*Ranunculaceae*" of the "Flora of Tropical East Africa" has taken longer than was expected, and the publication has had to be postponed till 1952. Dr. W. B. Turrill has nearly completed the "*Oleaceae*" for the Flora, and Mr. B. Verdcourt has written the account of *Cuscuta* L. Work on a number of other families is to start in the New Year.

The loss of Mr. R. D. Meikle, who has been placed in charge of the Europe, Orient and North African Department, has seriously affected the work on the collections from West Africa, the naming of which is now in arrears.

Work on a revised edition of Hutchinson & Dalziel's "Flora of West Tropical Africa" was started in July by Mr. R. W. J. Keay, who has been temporarily attached to Kew through the kindness of the Chief Conservator of Forests, Nigeria. It is expected that the work of revision will occupy at least two years.

Thanks are due to Prof. K. Süssenguth, Dr. C. E. B. Bremekamp, Dr. Horn af Rantzien, and Mr. A. C. Hoyle for kindly naming for us specimens of their special groups. We are also grateful to our colleagues at the British Museum and at Brussels and Paris for much assistance with determinations.

The work on the enumeration of L. J. Brass's plants collected on the Vernay Nyasaland Expedition, 1946, is now nearing completion. Much research has been put into this work, mainly by Mr. J. P. M. Brenan, which should be a most useful publication. Other research has continued on *Trifolium*, *Zornia*, *Rhus*, and certain genera of *Commelinaceae*, to mention the more important groups.

Visitors to Kew who worked on African plants during the year include Mr. P. J. Greenway, Dr. H. Wild, Mr. B. Verdcourt, Prof. A. S. Boughey, Mr. C. D. Adams, Mr. W. G. Dyson, Monsieur P. Piérart, Monsieur W. Mullenders, Dr. F. W. Andrews, Dr. F. A. Mendonça, Dr. J. G. Garcia, and Dr. A. R. de Torre. Dr. G. Cufodontis returned to Vienna in February, 1951 having completed his work on the African species of *Pittosporum*.

In October, members of A.E.T.F.A.T. held a Meeting and Symposium at Brussels University, through the kind invitation of Prof. P. Duvigneaud. Prof. L. Hauman presided, and members from nine countries attended. Kew was represented by Mr. Meikle and Mr. Milne-Redhead, whilst Mr. R. W. J. Keay also attended.

South Africa. The Botanist in charge returned to Kew in mid-September, after a two years' tour in Central Africa. On the way home he visited Pretoria and Cape Town, where he had meetings with most of the prominent systematic botanists of the Union. The already cordial relationship between Kew and the National Herbarium, Pretoria, the Bolus Herbarium and Kirstenbosch were thereby further strengthened.

Mr. B. de Winter, seconded to Kew under the now long-standing arrangement with the National Herbarium, Pretoria, has undertaken all general information work, and is proceeding with a study of South African *Gramineae* and also reports that during the course of the year the following revisions were commenced and are to be continued in 1952:

(1). Revision of the South African species of *Royena*. This is almost completed but still in manuscript form.

(2). Revision of the South African species of the genus *Eragrostis*. More than 700 specimens have been critically studied and identified, and a few descriptions written.

(3). Three new genera of South African grasses have been described and are being prepared for publication in the Kew Bulletin.

(4). About 400 miscellaneous South African plants mostly critical species, or species unnamed in the National Herbarium have been identified.

(5). A number of problems in nomenclature were dealt with for the National Herbarium, Pretoria.

(6). Studies on the morphology and anatomy (at the Jodrell Laboratory) of the South African species of *Aristida* are being continued.

The work of incorporating the large and valuable collections received from both Pretoria and Cape Town, as well as from other herbaria in the Union, has, necessarily, been considerably curtailed, but it is hoped that a return to more normal activity in this direction will be resumed in 1952. The collections of drawings and photographs received from Pretoria, have been incorporated ; these now number several thousands and it is a great pleasure to record the gratitude of Kew to Pretoria—and particularly to Dr. Dyer—for these generous and valuable gifts.

America. In the early part of the year much time was spent on the protection of types with special covers. Particular attention has been given to the collections of the Forest Department of British Guiana and the I.C.T.A., Trinidad. Large series of old specimens were received from the Jenman Herbarium, Georgetown, and were duly identified. The work of incorporating the unidentified Peruvian collections of C. Sandeman, W. B. Gourlay, Miss D. Stafford, and Mr. J. Sharpe is proceeding gradually. Large numbers of very valuable old specimens from all parts of America were received from a special source ; these were carefully gone through and very many of them have been distributed as duplicates.

Special work on Bignoniaceae : (a) The ms. of the account for the Flora of Trinidad and Tobago is still being perfected.

(b) Assignments of specimens from various institutions and private individuals have been dealt with. The largest and most valuable is a series from the Colombian National Herbarium.

Australasia. The investigation of the Australian species of *Trianthema* related to *T. decandra* has been completed. It was necessary to extend the study to Indian and African representatives in order to circumscribe the Linnean types. Four new species have been defined, primarily on fruit characters. The Tasmanian species of *Epacris* have been studied and two new species described.

Current acquisitions from Australia and the Pacific have been mounted and incorporated in the herbarium. Work on the Morrison collection of Western Australian plants has continued ; the groups named and mounted include, *Triglochin*, *Eucalyptus*, *Pimelea*, *Xanthorrhoeaceae*, *Haemodoraceae*, and *Stylidiaceae*.

Orchidaceae. The ordinary routine naming of living plants from the Gardens and of collections from many areas was continued. As in previous years collections from Africa predominated, in particular large collections from Nigeria, received from the Forest Herbarium, Ibadan, and Belgian Congo orchids on loan from the Brussels Botanic Gardens.

Research work was continued on African orchids in general but especially in connection with the revision of the Flora of West Tropical Africa, Professor W. Robyn's Flore du Parc National Albert, and the Flora of Tropical East Africa.

Gramineae. The main work on the group has been the naming of several thousand specimens from all parts of the World, but principally from tropical Africa. The most important of these have been from the British Commonwealth territories in eastern Africa, especially from Kenya, Uganda, Tanganyika, the Rhodesias, and Nyasaland. We now possess an extensive series of Nyasaland grasses, over 310 species, from nearly 100 genera, being represented from an area less than one-third the size of the British Isles. Valuable collections have also been received from Sierra Leone, Nigeria, French Cameroons, Belgian Congo, Anglo-Egyptian Sudan, Portuguese East Africa, Australia, India, Pakistan, Arabia, the Argentine Republic and the United States.

Assistance has been given to numerous visitors and correspondents on matters pertaining to the nomenclature of grasses, their classification, the examination of types, etc., and on various economic applications of these plants.

In the extremely large collections received during the past twenty years, a number of new genera and many new species have peen noted, of these an account of six new genera has been prepared for publication and a further batch of new species described, entailing the revision of several of the genera concerned. Work has also continued on the manuscript for the Flora of Tropical Africa, and a list has been prepared of the species recorded from the area of the new Flora of Tropical East Africa.

Cyperaceae. Much time has been spent, as in previous years, on the

determination of the *Cyperaceae* in collections from various parts of Tropical Africa. Preliminary research was begun on the African species of *Mapania*. Various sheets of *Cyperaceae* from the Trinidad herbarium have been examined and named or corrected in connection with the forthcoming Flora of the Island. Malaysian *Carex* collections continued to come from Java for critical determination and inclusion in "Carex in Malaysia", published in December. Further New Zealand *Carex* and *Uncinia* have been received and critically named. The first part of a thesis on phylogeny in the *Cariceae* has been written and has gone to press.

Vascular Cryptogams. Mr. Ballard returned from a three months tour of Ceylon in late February with a collection of plants which included approximately 400 numbers of ferns. This material, which has yet to be worked out, should prove a most useful addition to the Kew collections from this island which are generally poor and seldom localised.

Apart from routine naming, etc., research work has been mainly restricted to East African ferns. The enumeration of the ferns of the Vernay Nyasaland Expedition was completed during the year.

Bryophyta. Miss J. Taylor, B.Sc., was appointed to commence work as a Scientific Officer on 1st June, 1951. She has been placed in charge of the Bryophyta and has commenced the determination and laying-in of the large number of specimens of this group accumulated for many years. It is hoped to have the rich collections of this group at Kew made still more accessible for research work and new collections speedily named and incorporated.

Fungi. Attention has been given principally to studies in West Indian *Agaricales* with a view to naming the collections made in Trinidad in 1949. This has involved re-examination of all the species of *Marasmius* published from tropical America by Montagne, Berkeley, Murrill, and Spegazzini. The first of a series of papers on the Trinidad collections was published in December, the manuscript of a second, completing the *Leucosporae* has gone to press and a start has been made on determination of the *Rhodosporae*. Some progress has also been made with a revision of the British *Helotiaceae* but much further work is required before a satisfactory treatment becomes available. Publication of the previous revision of British *Hyaloscyphaceae* markedly stimulated interest of British mycologists in the group and material of several apparently undescribed species has been received this year, notably from Mr. W. D. Graddon. In July the mycologist was invited to join a collecting expedition by Prof. J. W. Heslop Harrison to the Isle of Rhum. The list of fungi obtained includes several European *Ascomycetes* not hitherto recorded from Britain.

The usual large number of fleshy fungi has been received for determination, notably those collected in floral surveys of sandy shores and coastal dunes, in Devon and Ireland. The Myxomycete collection has been rearranged in boxes instead of on herbarium sheets and the working collection of British fungi has been greatly enlarged and rehoused. A special effort has been made to equalise exchange accounts with certain foreign herbaria, notably Michigan, Ottawa, and Uppsala.

Dr. G. H. Cunningham worked in the department for five months on

his proposed revision of Australasian *Aphyllophorales*. Prof. N. J. G. Smith has been working throughout the year on South African *Gasteromycetes*. Mr. P. K. C. Austwick continued his work on anatomy of *Polyporaceae* until his studentship terminated in October. Miss E. M. Wakefield retired in July. Mr. D. A. Reid was appointed Assistant Mycologist on 5th September, 1951.

Algae. During the past year there have been more than the usual number of enquiries involving research into the literature and microscopic examination of specimens. These came from institutions abroad where herbarium and library facilities are inadequate. Loans of herbarium sheets have been freely made and copies of manuscripts supplied. Other queries related to identity and distribution of gel producing weeds and of wracks for manurial purposes. Queries on lawn and pond algae came in as usual in the late summer.

Considerable interest was shown in an exhibit put up in the Herbarium to illustrate "Seaweeds in Industry". This was made possible by generous assistance from Alginate Industries Ltd., the Institute of Seaweed Research at Musselburgh, and the Marine Station at Millport.

Additions to the alga herbarium have been made by 190 specimens from the University of California sent as an exchange, a set of Mediterranean seaweeds presented by Mr. A. Bursa, and the purchase of a set of Foslies' Coralline Algae.

Work on the Gold Coast Algae is being continued in collaboration with Mr. Lawson who is stationed at Achimota. He has already made a few additions to the list by dredging.

Spirit Collection. Approximately 1,000 gatherings were added to the collection during the year. These were mainly of African origin and included, in addition to valuable orchid collections, critical material of *Monadenium* (*Euphorbiaceae*) *Acanthaceae*, *Lentibulariaceae*, and *Marantaceae*.

National Dianthus Collection. Approximately 80 species are now in cultivation, and an extension to the Experimental Ground has allowed room for additions. Mrs. Adler continued to assist with records and classification, and has undertaken a detailed study of *Dianthus carthusianorum* and its allies.

Collectors are sincerely thanked for the many contributions of *Dianthus* seed received during the course of the year. More seed is wanted, particularly from the Balkans and the Orient.

Experimental Ground. Recent extensions have almost doubled the area of the Ground, and it will now be possible to re-arrange the *Dianthus* and miscellaneous collections. Valuable gifts of seeds have been forwarded from Korea by S/Sgt. Moorcroft, and specimens grown from these seeds will be preserved in the Herbarium. Many interesting plants from Cyprus and the Near East flowered during the course of the year.

Fumigation Chamber. The main Hydrogen Cyanide chamber was used on routine fumigation of incoming material on twelve occasions during the year. Insect attacks in the herbarium continue to be few and of a minor character. A small chamber of 5 cubic feet capacity, utilizing Methyl Bromide as a fumigant, has been designed and installed by the Ministry of Works. Methyl Bromide is quicker in action than Hydrogen Cyanide

and less readily absorbed by treated material. The new chamber is intended to deal with small parcels of specimens which are required for urgent study as the whole fumigation process can be completed in three hours. It will also prove useful in dealing promptly with outbreaks of insect attack ; the chamber was used for the first time in August and on fifteen occasions afterwards.

Index Kewensis. The compilation of Index Kewensis, Suppl. XI–XII (1941–50) has made very good progress during the past year. The work on the periodicals and independent works received at Kew has been completed. Three months have been spent in going through the periodicals in the Natural History Museum Library. Press-marking was started on October 1st and the first half of the manuscript (A–K) was sent to the Clarendon Press early in December. It is hoped to send the second half at the end of February, 1952.

Botanical Magazine. Volume 168 (N.S. tt. 133–175), edited at Kew by Dr. W. B. Turrill for the Royal Horticultural Society, was published in four parts. Of the 44 articles, 38 were contributed by members of the Kew staff. Much original research preceded the preparation of many of the text accounts. The Royal Horticultural Society has presented the originals of the coloured plates and of the black and white text figures to the Kew Herbarium. The volume was dedicated to Col. F. C. Stern, O.B.E., M.C., F.L.S., V.M.H.

Icones Plantarum. Volume 5 (Fifth Series), part 4, was published in December, 1951. It consists of plates 3476 to 3500, with accompanying text, representing new or rare species preserved in the Kew collections.

The Library

As in former years routine work has taken up a considerable amount of the time of the library staff. Many enquiries of a varied nature have been dealt with and a great deal of investigation has been carried out.

The steady improvement in the binding shown last year has been well maintained. During the year over 900 volumes were sent to be bound, re-bound, or repaired.

The material for the new pasted down copy of the Index Kewensis has been acquired including loose-leaf binders and two complete copies of the Index. It is hoped that work on this new copy will begin in 1952.

The collection of books on bryology was transferred during the year from the ground floor corridor to shelving at the end of Wing C near the bryological department. This transfer relieved to a great extent the pressure on shelving in the corridor, and opportunity was taken at this time to re-arrange the section on fungi.

The library has continued to lend books to other Government Departments and Agricultural Bureaux while we, on our part, have borrowed certain publications from other libraries for the use of members of the staff at Kew. We have also administered loans of books, as usual, on behalf of the Bentham-Moxon Trustees, from the Frederick Adams collection, to workers on *Diatomaceae.*

The Bentham-Moxon Trustees have presented a number of valuable Linnean dissertations not hitherto represented in the library. They have

also enabled Kew to receive the continuation of various journals by placing at its disposal exchange copies of Hooker's Icones Plantarum.

Books have been most kindly presented by Her Majesty Queen Mary, by various authors, by members of the staff and others, while some have been received from the publishers for review in the Kew Bulletin. We are once again indebted to many authors too numerous to mention here for reprints of their botanical papers.

Among the many societies, academies and other institutions which have again made liberal contributions to the library may be mentioned the Royal Swedish Academy of Sciences, Stockholm ; Geobotanisches Forschungsinstitut Rübel, Zurich ; Danish Botanical Society ; New York Botanical Garden ; Smithsonian Institution ; Jardin Botanique de l'Etat, Brussels ; California Academy of Sciences ; Division of Botany, Union of South Africa ; Royal Horticultural Society; Carnegie Institution of Washington ; United States Department of Agriculture ; Empire Cotton Growing Corporation and the Commonwealth Agricultural Bureaux. Many other Departments of Botany, Agriculture and Forestry, at home, in the Commonwealth, and countries overseas, have also sent us publications, and some of these now form sets of considerable extent and value.

Photostat copies of rare and important publications have been made for us by the Ministry's Photographic Department, thus making available at Kew much additional valuable material.

The collection of drawings has been still further enriched by presentations from various generous donors and valuable additions have been made to the map collection by presentation and purchase.

The Museums

Whenever possible the time of the Museum staff has been utilized during the year in completing the re-arrangement of specimens in No. 1 Museum, details of which were given in last year's report. It is estimated that well over thirty thousand specimens weighing many tons have now been moved or transported from one part of the building to another during the course of the work. The work was completed towards the end of the year. Fortunately it was found possible to accommodate all the reference material (with the exception of wood specimens) on the top floor leaving the ground floor and most of the middle floor free for the public display cases. The reference collection of wood specimens has been housed partly in the old office on the middle floor and partly in the cases adjoining the office. It is intended that a door and partition will eventually shut off this wood collection from the public part of the building.

The arrangement of the reference collections has been retained under the natural system (Bentham and Hooker), but the material in the public display cases has been arranged according to subjects such as the following :—food and beverage plants, spices, drugs and narcotics, oils, rubbers, fibres, gums and resins, waxes, dyes, tans, tobacco, insecticidal plants, etc. There are also a number of cases devoted to miscellaneous exhibits such as interesting seeds and fruits, gourds, poisonous

plants, weeds, plant remains from ancient tombs and archaeological investigations, etc.

The collection of drift seeds which has been in Museum No. 1 for many years but which had become somewhat over-crowded is now shown to much better advantage in a larger case. Specimens have been re-labelled and a large chart provided showing the main ocean currents which should assist the general public in a better understanding and appreciation of the subject. The collection is a valuable one in that it contains specimens collected by Guppy, Muir, and other well known authorities on the subject.

Various specimens and illustrations relating to the early days of Kew that existed in different parts of the Museums have now been brought together and arranged as a special exhibit in Museum No. 1 and should interest some sections of the general public.

The enquiries dealt with during the year have covered a wide range of economic plant products. Several enquiries have been received in regard to a species of *Kochia* (believed to be *Kochia indica* Wight) and its value as a forage or fodder plant in arid regions. *Kochia indica* occurs in the north west of the Indian Subcontinent, also in Afghanistan. It has long been known to be a useful camel fodder. The plant in question has become established and has proved of great value in parts of North Africa. It is said that at about the time of the battle of El Alamein, Australian and New Zealand forces received stores (presumably from India) packed in an unusual kind of straw or packing material. This was blown about into the mine fields and seeds from it germinated and grew. Subsequently, owing to the danger of mines, the local nomads were unable to graze their animals there with the result that the plant flourished, set seed and multiplied. It is said to constitute a useful food for cattle, sheep, mules and poultry and that in irrigated patches it may reach six feet in height and commence to flower after about four months. In view of the plant's ability to thrive under adverse conditions it is quite possible it may prove of value in other areas where conditions are similar to those in North Africa. At present the identity of the plant has not been finally confirmed by adequate herbarium specimens but it is expected this will be possible shortly.

A difficult task during the year was the identification of over a hundred Chinese drugs of vegetable origin from Fiji, having been imported by local Chinese from Hong Kong and possibly other eastern ports. It was possible to name most of the samples by comparison with Dr. D. Hooper's collection of Chinese drugs from Malaya and with other museum specimens. Many of the specimens required anatomical examination at the Jodrell Laboratory. On the whole the material was very similar to the collection from Malaya described by Hooper in 1929.

An abnormally large number of enquiries were received concerning dye plants, especially madder (*Rubia tinctorum* L.) woad (*Isatis tinctoria* L.) and other dye-plants of temperate regions, which suggests a revival of interest in these old-time dyes, possibly in home dyeing.

There have been many enquiries, often accompanied by specimens, regarding abnormal growth in plants. These have included several specimens of the foxglove (*Digitalis purpurea* L.) showing fasciation and

abnormal development of the terminal flowers, fasciation in *Forsythia* and buttercup, a " double " cider apple, proliferation of the flower in roses, and the phenomenon known as " hen and chicken " in the daisy (*Bellis*) and marigold (*Calendula*). It is believed the abnormal weather conditions early in the year may have been responsible in some instances for the abnormal growth.

Among the more interesting seeds received during the year were some which had been discovered during archaeological excavations in a good state of preservation on an Anglo-Saxon town site at Southampton. These proved to be stones of the bullace (*Prunus institita* L.) and the wild plum (*Prunus domestica* L.). Seeds of " shib-juta ", said to be an Indian fibre plant, proved to be those of the Nilgiri neetle (*Girardinia palmata* Gaud.). Plants raised from the seed were found to possess exceptionally vicious stinging hairs.

A substance called " rita ", said to be sold as a soap substitute in the bazaars of Baghdad, was found to consist of fragments of seeds of a species of *Sapindus*.

An unusual object picked up in ocean drift at Gravesend proved to be a fruit of an Australian *Banksia*. It may have been discarded from a ship that had come from Australia. There is also the possibility that it may have drifted from the Scilly Isles where a number of species of Banksia are known to be grown.

Other miscellaneous enquiries dealt with during the year have been concerned with the following :—the nature and botanical source of " Madagascar gum " (now considered to be derived from *Poinciana adansonioides* R. Vig.) : the uses of cherry gum : information concerning locust seed gum (*Ceratonia siliqua* L.) and other similar " seed gums " : the cultivation of pepper (due to the acute shortage of this spice) : identification and uses of Tiger nuts (*Cyperus esculentus* L.) and of South American Paradise nuts (*Lecythis usitata* Miers.)—the latter again on sale in Britain after a lapse of many years : the uses of Java weed (*Eichornia crassipes* Solms.) from Siam as a paper making material : medicinal properties of *Lithospermum ruderale* Dougl. : information concerning the oil yielding grasses " palma rosa " (*Cymbopogon martini* Stapf. var. *motia*) and gingergrass (*C. martini* Stapf. var. *sofia*) : the identification of various weed seeds and grain impurities ; the possibility of the commercial cultivation of spearmint (*Mentha viridis* L.) for oil in Britain : the cultivation and preparation of angelica (*Angelica officinalis* Moench.) : the toxicity of wild celery (*Apium graveolens* L.) : the cultivation and uses of " Napier " grass (*Pennisetum purpureum* Schum.) : the cultivation of Kudzu (*Pueraria thunbergiana* Bth.) : information on the sweetening properties of *Stevia rebaudiana* Hemsl. : growth characteristics of esparto grass (*Stipa tenacissima* L.) : cultivation of ipecacuanha (*Psychotria ipecacuanha* Stokes).

Among the donations received during the year were the following :—a good collection of vegetable waxes from one of the well known firms of polish manufacturers : photographs of vegetables of various kinds (these have proved most useful in connection with the vegetable exhibits now on view in Museum No. 1) : photographs and other illustrations of the tea industry from the Tea Centre (Lower Regent St., London) : an interest-

ing series of *Posidonia* balls from the Egyptian coast presented by the late Prof. F. W. Oliver.

The Keeper was absent on leave in South Africa during the early part of the year when the opportunity was taken of visiting various institutions concerned with the plant sciences and of making or renewing contact with the personnel. Advantage was taken of procuring seeds and specimens of various kinds, particularly specimens likely to be of value in the Museums.

In July the Keeper attended (unofficially) the first meeting of the newly constituted Commission for the study of bee plants (i.e., plants of value to the hive bee for nectar or pollen) held at Leamington. This Commission was recently established by the Council of the Botanical Section of the International Union of Biological Sciences (I.U.B.S.), the chairman being Dr. A. Maurizio (Bienen-Abteilung, Liebefeld, Bern). Assistance is being given in connection with a World list or catalogue of bee plants which this Commission hopes eventually to build up and a list has already been submitted for the British Isles by Dr. Howes. It is anticipated that many difficulties will arise when some of the less well developed countries are dealt with in which apiculture in some form or other is practised and " bee pasturage " is of importance.

The International Poplar Congress was attended by one member of the staff (Mr. Harrison) although it was not possible for him to be present at all the meetings which were held in different parts of the country. Nevertheless good opportunities were afforded for exchange of views with botanists from other countries.

Assistance has been given in the identification of Conifers at the National Pinetum at Bedgebury, one visit having been paid by Mr. Harrison in the autumn.

In collaboration with the European Department of the Herbarium a wide range of *Salvia* material from different parts of Cyprus, obtained by the Colonial Products Advisory Bureau for oil distillation, has been critically examined and named.

Among the early specimens donated to the Museum were seeds of certain clovers and other plants presented in 1851. Germination experiments (made by Miss Youngman) with some of these old seeds, now a hundred years old, have yielded interesting results, an account of which has been published separately.

Jodrell Laboratory

The most important research work in progress has been concerned with the comparative anatomy of the vegetative organs of the Monocotyledons, special attention having been devoted to the Gramineae. Much of the work has been of the unspectacular type that is necessary during the early stages of a major investigation. Thus considerable time has been devoted to card indexing literature, and to making preliminary observations on the great wealth of microscope slides that is gradually being prepared by Mr. F. Richardson and Miss D. M. Catling. As was anticipated in the report for 1950, the appointment of Miss Catling as a Scientific Assistant has greatly expedited the preparation of slides of Monocotyledons. Apart from grasses cultivated at Kew, slides have

been made of others collected in Ceylon by Mr. Ballard, and in Nigeria by Mr. Meikle. The Keeper has worked out a system for recording information concerning the anatomy of the Gramineae on perforated index cards. The actual recording of the information has recently been started, and it is expected that this new system will not only make it easy to sort out facts, but will enable correlations between characters to be established very quickly. The system is similar to one that has now been generally used for some years to identify timbers. The new perforated card system has entailed the preparation of a considerable number of line drawings to serve as standards. Several consignments of interesting Tasmanian Monocotyledons, preserved in formalin, have been sent from Hobart by Dr. W. M. Curtis specially for the anatomical work now in progress.

Dr. M. Y. Stant assisted with the work on the Monocotyledons by making a study of the Alismataceae. She also completed an investigation of the anatomy of certain species of *Stackhousia*, and wrote an article on this subject which has recently appeared in the Kew Bulletin. In addition, when identifying some samples of Strophanthus seeds, she made a special study of the well known diagnostic colour changes that these seeds undergo when treated with sulphuric acid, and demonstrated that temperature has a more pronounced influence on the reaction than was previously realized. Attempts were made to standardize the colours by comparing them with Ridgway's colour charts.

The routine work has, as usual, consisted mainly in identifying miscellaneous botanical materials from the microscopical structure. Mr. Richardson's great skill in preparing microscope slides of refractory material, together with his wide knowledge of the structure of timbers and other economic plant products, have been of the greatest value in connection with this work. Apart from a number of unfamiliar and difficult timber specimens, about 60 samples of portions of Chinese plants with reputed medicinal properties were identified. Samples of charcoal, leaves, and other plant remains that had been excavated by archaeologists from Iron Age, British and Roman sites were examined and identified as far as possible. Other items included the remains of beech leaves from the rumen of a cow ; a root used to produce foam in Persian laundries which was identified as that of a species of *Acanthophyllum*; a piece of rope manufactured in Gloucestershire from the bark of a lime tree. A number of fragments of barks and twigs on which fungi were growing were identified at the request of mycological colleagues from the Herbarium and Commonwealth Mycological Institute. Enquiries concerning physiological subjects such as the ascent of sap in trees and respiration, etc., have been answered. Microscope slides of timbers and other miscellaneous items have been added to the reference collection throughout the year. These slides have been made in connection with the routine investigations just described, and are additional to those of Monocotyledons mentioned in the first paragraph of this report.

A number of botanists have visited the laboratory to discuss anatomical problems and to see the laboratory techniques that are employed.

The Keeper served on a pharmacognosy committee set up by the Pharmaceutical Society of Great Britain, to assist in revising the 1949

edition of the British Pharmaceutical Codex. Meetings of the committee were held at intervals throughout the greater part of the year.

The Gardens

The first quarter's rainfall was exceptionally heavy and over 6 inches of rain fell in the month of February. No prolonged dry periods occurred during the year, and the annual rainfall totalled an excess of more than 10 inches over the average. Though one would have anticipated the river water consumption would be much lower than in a normal year, some 21,260,000 gallons were consumed.

Arboretum

During the year 36 large trees, of which 19 were beeches, had to be removed because of their dangerous condition. The exceptionally wet weather has doubtless been responsible for the acceleration of decay. In most instances decay had been brought about by attacks of honey fungus. Amongst the trees removed was a large Scots Pine (*Pinus sylvestris*) near the Temperate House. One of the largest trees in the Gardens, it had shown signs of ill-health for some years and at the time of its removal was completely dead. An Atlas Cedar (*Cedrus atlantica*) growing near to the Japanese Gate, also had to be removed. The tree, like several other cedars growing in that area suffered severely from the 1949 drought. Another landmark disappeared when the very old and historic Horse Chestnut in front of No. 4 Museum had to be removed. On the Mound adjacent to Cumberland Gate several of the very old Elm trees became infected with disease and the trees had to be pollarded as a safety measure until such times as they could be removed entirely. It is regrettable that after the removal of so many trees during recent years, in the interests of public safety, a fatal accident should have occurred in the Gardens on Sunday, December 9th, when the top of a dead Turkey Oak (*Quercus cerris*) situated in the woods near the Rhododendron Dell, snapped off and crashed during an exceptionally gusty wind, which caused the death of a six year old boy then playing with others in close proximity to the tree. Every care is, of course, taken to ensure removal of trees before they become dangerous, but with thousands of trees involved, accidents may occur in exceptional conditions, despite regular inspection.

The planting of the Acer collection has been completed, and a number of young trees of various species have replaced trees taken out in previous years. A new Berberis hedge (*Berberis Darwinii*) has been planned to improve the amenities around the refreshment Pavilion. The work necessitated the removal of some ten trees, chiefly Aesculus of hybrid origin, and the preparations were completed in readiness for planting, early in the new year.

The general display of flowering trees and shrubs was good throughout the year. Magnolias, Rhododendrons, Prunus, Spiraea, Malus, Philadelphus and Diervillas being noteworthy. Among winter flowering shrubs, Hamamelis species were again of exceptional merit, whilst amongst the late summer flowering shrubs, Hibiscus syriacus in its various forms, Eucryphia glutinosa and the Clethras were good.

Individual subjects that proved outstanding were Paulownia tomentosa,

Catalpa speciosa, Stewartia malochodendron and Prunus subhirtella var. autumnalis. The latter was cut by frost early in December, but rapidly produced a fresh crop of flowers to continue the display. Flowering of several other shrubs should also be recorded. They include the new hybrid Viburnum—V. bodnantense, Eucryphia nymansay, Magnolia officinalis, M. sinensis var. grandiflora and Rehderodendron macrocarpum. The most remarkable feature of the Gardens this year has been the very free fruiting of all kinds of Hollies. Owing to the mild weather they were not interfered with by the birds and it is doubtful if such a fine crop of berries has been borne for very many years.

Despite the excellent displays of blossom, seed crops have not been good, weather conditions, particularly in early spring, preventing adequate pollination and setting of fruits, especially amongst Rosaceae. Conifers failed almost entirely, whilst Magnolias produced hardly any seed. It is, therefore, of special interest to record that despite the unfavourable season, the following subjects ripened seeds and will be available for distribution :—Catalpa speciosa, Convolvulus cneorum, Ehretia dicksonii, Nyssa sylvatica, Picrasma ailanthoides, Pittosporum crassifolium and P. truncatum. Similarly a number of Quercus which do not normally seed freely, this year produced crops of good seed. Numerous living specimens of young trees and shrubs have been sent out. New introductions during the year included Paulownia fortunei, Magnolia loebneri, Populus lloydii, Clematis verticillaris and Viburnum ichangense Amongst collections of seeds received, those from Dr. H. Sleumer, collected in Southern Patagonia and S/Sgt. G. E. Moorcroft collecting whilst on active service in Korea, are both noteworthy and may produce some interesting and valuable plants.

The repairs to the wall of the HaHa near Isleworth Gate were completed during the early part of the year. On the Clematis wall, constructed two years ago, a number of species have become well established and good growth has been made. The main problem with the specimens hanging over the wall, is a satisfactory means of anchoring the growth.

Composting of grass mowings, leaves and coffee residue continues, these materials proving invaluable with stable and farmyard manure in short supply. Coffee residue, after a reasonable period of composting, is proving excellent, serving as a good mulch and also keeping weeds in check. With the wet season, grass cutting became a major operation and the addition of a further set of triple gang mowers and tractor greatly helped in keeping the grass under control. With the exception of the demonstration plots and staff allotments, the whole of the land devoted to food production since 1940, has now been returned to lawn, and that part of the Gardens in the vicinity of Kew Palace has now regained much of its pre-war appearance.

The labour problem continues as one of our major difficulties, the seriousness of which is emphasised by the fact that no fewer than 25 changes occurred in the department during the year. This continual changing of staff, coupled with a reduction on pre-war numbers, no seasonal workers and a shorter working week, have all added to the labour problem.

Tropical Department

Palm House

Four permanent beds were re-soiled during the summer months, the large specimen plants being re-arranged to give more head room, and a few smaller Palms were added to re-furnish the beds. Despite the lack of sun the Banana plants flowered and fruited well, especially Musa Gros Michel, presented to the Gardens by Messrs. Elder & Fyffe in 1949, this being the first time this Musa has been fruited at Kew. The following plants of interest flowered during the summer :—Chamaedorea elegans, Hibiscus schizapetalus, Eugenia lanceolata and Solandra hartwegii.

House No. 15

The tropical water lilies gave a magnificent display during the summer, the plants having been propagated from material received from Mr. G. H. Pring, Missouri Botanic Gardens, the previous year.

Tunnel

The old obsolete rail track in the Palm House Tunnel has now been taken up and a new concrete floor laid enabling the coke supplies to Palm House stoke-holes to be carried by a new electric truck. This should greatly improve working conditions.

T. Range

During the early spring the panoramic background of the Mohave Desert in the Sherman Hoyt House, was beautifully restored by Mr. G. Atkinson. It was necessary to lift the Cacti in the permanent bed in the foreground, and re-arrange them, taking out the overgrown specimens, which were replaced by smaller Cacti to blend in with the background. The soil surface was re-covered with coloured sand obtained from the Isle of Wight and Devon.

South African House

The plant collections in this house have improved considerably since the beds were renovated and a large number of new specimens introduced. Many of the mimicry plants—Conaphytums and Lithops, have flowered better than previously.

Orchid Houses

In early spring and throughout the summer months there was a good display of blooms and the lack of fog and ripening of the pseudobulbs no doubt contributed a great deal to this result. Large specimen plants of Cymbidiums, Dendrobiums, Eulophias, Paphiopedilums, Stanhopeas and Vandas were very outstanding. Several new orchid plants were received during the year from Messrs. P. G. Archer, of Kenya, B. L. Perkins, Nairobi, H. W. Simmonds, Fiji, J. R. Mann, South Africa, and J. A. Hood, Transvaal.

Ferneries

Several consignments of Fern material were received from Ceylon early in the year. This valuable collection comprised about 160 species collected by Professor Manton and Mr. F. Ballard during an expedition to Ceylon. The majority of the plants became well established before the end of the year and greatly enriched the Fern collection. Material from practically all the plants has been supplied to, and fixed by Professor Manton, for cytological examination.

Festival of Britain

At the request of the authorities, a greenhouse inside the Dome of Discovery at the South Bank Exhibition was furnished with economic plants and with a few decorative tropical plants. Artificial lighting and tubular electric heating, coupled with dusty, dry arid atmosphere, was not conducive to tropical plant growth and only daily maintenance and regular exchange of material enabled the exhibit to be maintained in a reasonably good condition.

Quarantine House

A new Quarantine House was erected at the request of the Colonial Office, in the Melon Yard, and was completed in the early part of the year. 70 feet long and 20 feet wide, the house is divided into two sections, each with adequate propagating facilities and modern equipment. Over 200 leaf cuttings of various clones of Cocoa have been propagated and will be ready for despatch early in the new year. Some new clones of Cocoa from Trinidad were received in the summer months, all consignments having arrived in good condition. These are to serve as stock plants and material will be propagated from them next year. Large numbers of stocks of Hevea brasiliensis have been grown on and will be suitable for budding next spring with the high yielding varieties from Malaya. 24 selected budded Hevea clones were received by air from The Rubber Research Institute, Malaya, but owing to the lack of fibrous roots on the stocks, only 4 survived.

It has been found that the best method of sending rubber seedlings overseas is to pack them in slightly moist, peat moss litter, and to despatch them by air in sealed tins. Consignments for Malaya and Ibadan sent in this way arrived in excellent condition.

Various consignments of Bananas for quarantine were received from Zanzibar, Kampala, Nairobi, Dar-es-Salaam, Jamaica and from Accra, Gold Coast. Two very large consignments of Musa suckers comprising 45 varieties were despatched to The Imperial College of Tropical Agriculture, Trinidad.

Alpine and Herbaceous Department

New work done in the department during the year included the construction of a new greenhouse in the Alpine propagating yard (No. 25B) similar in design to that of the Alpine house, with good ventilation on both sides. To enable the temperature to be kept above freezing point during the winter, a coil of hot water piping has been installed in each side under the concrete staging. It is hoped, when more space becomes available, to utilise this house for propagation purposes. A new lean-to shelter has been erected in the department's storage yard. New wooden lath blinds on rollers have been fixed on to Alpine house, No. 25 and 25B. These are to replace the cotton type which is now unobtainable for summer shading. The lath types are considered an improvement on the old type.

In the rock garden another portion of reconstruction was carried out involving the removal of a considerable amount of limestone and tufa rock on which the Saxifraga collection were growing, and rebuilding with

Sussex sandstone similar in design to that done in previous years. It included two outcrops and the building of a new stream which was fed from two high waterfalls. This has provided extra accommodation for moisture loving plants, such as Primulas, Rodgersias, Mimulus, Ferns, etc., which is badly needed in the rock garden. As this piece of reconstruction took longer than was anticipated due to bad weather, no further rebuilding or resoiling of other parts of the rock garden were undertaken.

The Iris garden again provided a wealth of colour during the first few weeks of June, which was prolonged this year by cool overcast conditions which prevailed at the time of flowering. In spite of the wet weather during the latter half of the summer, very little rhizome rot was seen. This can be very troublesome wherever Iris are grown. For the growing of alpines and herbaceous plants generally, the weather this season was ideal ; many plants such as Meconopsis, Primulas, and other moisture loving plants flowered and put on considerable growth. The good display of flower again provided much attention in the Alpine house during the early spring, with large pans of various species of Muscari, Crocus, Narcissus, Tulips and many other miscellaneous bulbous plants, to be followed by Campanulas, Saxifragas, Lewisias and some of the more uncommon types of dwarf annuals such as petalum walkeri, Sedum gattefossei and Campanula broussonettiana, which all help to prolong the flowering season well in the month of July.

Among the many interesting collections of seeds and plant material received by this department during the year were a collection of seeds sent in by Dr. R. Wygnanki which he collected in the Magellan Regions of South America. Sgt. Moorcroft now serving in the Forces in Korea, continues to send in from time to time considerable numbers of seeds which he is able to collect. Seeds of Corydalis cashmiriana, a very scarce plant native to the mountains of Kashmir, were received from Dr. G. Taylor. Mr. K. R. Wooster presented several small tubers of Serapias laxiflora, collected in Cyprus. Dr. H. Sleumer sent unusual seeds from South Patagonia and Canon Raven bulbs of Tulipa saxatilis var. cretica, collected by him in the White Mountains. Valuable consignments were received from the Royal Botanic Gardens, Edinburgh, University Botanic Garden, Cambridge, The Royal Horticultural Society's Gardens, Wisley, Mr. W. Bentley of Quarry Wood and W. Constable of Tunbridge Wells.

Living material of the following plants was supplied to be figured in this year's volume of The Botanical Magazine :—

Penstemon gentianoides T.162.
Crocus nudiflorus T.169.
Hosta rectifolia T.138.
Penstemon kunthii T.154.
Ramonda nathaliae T.152.
Codonopsis rotundifolia var. angustifolia T.131.
Fritillaria sibthorpiana T.129.

A few outstanding plants flowered particularly well during the year, including Cassiope lycopodioides, a choice and beautiful plant belonging to Ericaceae, Fritillaria assyriaca, Romulea requieni, Orchis anatolica,

the very rare and interesting Ribes rotundifolia the flowers of which need protection from late spring frosts, Primula scapigera, forrestii and tayloriana, the latter a new species from Bhutan which normally does not like the dry atmosphere of Kew. In the Natural Order Beds, Cladanthus arabicus, a new plant recently figured for the Botanical Magazine, flowered and others included Salvia haematodes, Artemisia lactiflora, Polygonum renoutria and Cimicifuga cordifolia, all of which excelled themselves.

Delegates of the International Rock Garden Plant Conference, held in London in April, in conjunction with The Royal Horticultural Society, visited Kew on April 26th. The delegates were welcomed by the Director, after which they made a tour of the Rock Garden and the propagating department, expressing themselves as very pleased with the numerous alterations and improvements which had been made in recent years.

Decorative Department

During the past year the display of Darwin Tulips was again the main feature of the spring bedding, the beds on the Palm House Front being exceptionally good. All beds were treated with a disinfectant prior to planting the bulbs, and the absence of gaps caused through " Tulip Fire " in the bedding this last spring (1951) was very noticeable indeed.

The summer bedding display was very much admired by the many visitors to the gardens, especially the beds of Begonias on the Palm House Front which were inter-planted with various types of silver foliage plants such as Leucophyta brownii, Helichrysum microphyllum, Helichrysum rupestre and Senecio cineraria var. Alice, the latter standing out well in the beds of Begonia semperflorens var. Indian Maid.

The Rose Garden continued to show a marked improvement, the result of periodical dressings of artificial manures, together with the introduction of new stock.

The spring display in the Conservatory was very much better than in the past few years, fresh forcing material having been introduced plus good batches of Cyclamen, Primulas, Calceolarias, Cinerarias, Streptocarpus and Pelargoniums, etc. New stocks of both the winter flowering and Gloire de Lorraine types of Begonias helped to make the warm section of the Conservatory very attractive. During the period from September until the end of December, the Chrysanthemums again furnished the cool section, giving a good display of colour, the Charm varieties being more noteworthy and caused much interest amongst the many visitors.

Various repair works have been carried out during the year, the main item being the erection of concrete staging throughout the cool and centre sections of House No. 4. The interior of the above house was given its first coat of paint for many years, making a marked difference in the amount of light reflected during the winter months. Slight roof repairs were also carried out on the centre section, four complete lights having to be renewed owing to the timber being completely rotten.

The demolition of House No. 21 in the Melon Yard, along with the

old skeleton frame, took place towards the end of November, prior to the erection of two new houses in their place.

The Demonstration fruit and vegetable plots have once again been maintained by the department with a satisfactory yield of crops in spite of the poor conditions during July and August.

Temperate Department

The leaky condition of the roof has been mentioned in previous reports. The trouble persists, and several large soak-aways have been dug to carry off water from the paths after heavy rain.

In the interests of the efficient use of labour, a ramp with an easy gradient has been constructed near the south Octagon, giving access to the Temperate House for barrows and handcarts. Previously, all material entering the House was carried up steps.

A large Araucaria columnaris 55 feet high, which leaned over the centre path of the House was considered unsafe and removed. It has been replaced by another conifer rare in cultivation, the Brazilian Araucaria angustifolia.

Jubaea chilensis has fruited again, on a reduced scale this year. Lagerstroemia indica produced a few flowers in the Mexican House. This is believed to be its first flowering here.

A number of grasses collected by Mr. F. Ballard during his recent visit to Ceylon are being grown for cytological examination. A plot of a vegetatively reproduced grass being grown in Italy as Agrostis canina, but whose identity remains uncertain, has been planted on the Terrace for trial and further observation.

The Hebe collection outside the Himalayan House has been generally overhauled, and additional species for this collection are being raised for future planting. The assistance of Dr. R. Melville with this critical genus, as with other Australasian plants, has been greatly valued.

There has been a considerable increase in the collection of seeds ripening under glass in the department this year.

A start has been made on a card index to the plants cultivated in the department.

The new Australian House was completed before the end of the year but minor modification made it impossible to plant up before the New Year.

Plant Distribution.

Apart from the large numbers of living specimens distributed for exchange or for research purposes, 7,500 packets of seed were sent out from the Arboretum, 5,000 from the Alpine and Herbaceous Department, and a large number from the Decorative and Tropical Departments.

Economic Botanist

Sir Geoffrey Evans continued in this office throughout the year.

He visited the West Indies for a short period in March to represent the Governing Body of the Imperial College of Tropical Agriculture at its Jubilee Celebrations. Whilst on this visit, the opportunity was taken to discuss banana and cocoa research work, and the quarantine measures necessary in connection with these crops.

In August he attended the meeting of the British Association in Edinburgh and read a paper on " Land Settlement Problems in Undeveloped Tropical Areas ". He represented the Gardens at the Cocoa Conference convened by the Cocoa and Chocolate Alliance in London during September. He dealt with correspondence from the Colonies and Overseas concerning economic matters.

For the reasons mentioned in the last report, there has been a considerable increase in the number of tropical economic plants arriving at and leaving Kew, on account of the material required by research stations in the Colonies for their breeding and genetical work. The new Quarantine House, which was built from monies provided by the Colonial Development and Welfare Fund, was opened in February, and is now filled nearly to capacity with cacao and rubber plants undergoing quarantine. The house is divided into two sections, one portion receiving plant material coming from the Western Hemisphere, and the other plants from Africa and the East. The original plants are propagated by cuttings or buds before being sent on to their final destination. Inspection, before final despatch, is carried out by officers appointed by the Directors of the Commonwealth Mycological and Entomological Institute, respectively. Bananas are similarly quarantined in a green house that was built from Empire Marketing Board funds fifteen years ago. This development of Kew as a quarantine station appears to be increasing, and it looks as if before very long means will have to be found for providing additional houses, more particularly because cacao and rubber do not go very well together, requiring somewhat different conditions. The number of arrivals and despatches during the year up to December 1951, was as follows :—

Bananas. 71 plants received consisting of Lacatan from West Indies and five species from East Africa. Fifty East African clones despatched to I.C.T.A., Trinidad, and 20 Lacatan to the Gold Coast Agricultural Department.

Cacao. 124 plants of various clones arrived from West Indies and 24 rooted cuttings were despatched to West Africa Cocoa Research Institute, and 35 seedlings I.C.S.I. to Agricultural Department, Malaya.

The Banana House is already inadequate and it is becoming increasingly difficult to maintain it at the required tempearatures.

The Economic Botanist continued to sit on various sub-committees of the Colonial Advisory Council for Agriculture, Forestry and Animal Health, and remained Chairman of the Anti-Locust Research Committee.

He also continued to be Chairman of the National Pinetum Committee and paid various visits to Bedgebury, where many improvements to the Pinetum came into effect during the year, including the publication of a Guide to the National Pinetum.

Publications

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NOTES ON SOME TROPICAL AFRICAN SPECIES OF NAJAS IN THE KEW HERBARIUM.

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It is strange that so little attention has been paid to the genus *Najas* since the monographs of Rendle in Trans. Linn. Soc., 5 (1899–1900) and in Engler's Pflanzenr. 4 : 12 (1901). Walo Koch, one of the few botanists studying *Najas* during later years, supposed (Ber. Schweiz. Bot. Ges., 44 (1935) p. 339) that the reason might be the necessity to examine them very thoroughly microscopically. Most members of the sub-genus *Caulinia*, which includes the majority of the species, are superficially very much alike. As in other aquatic spermatophytes, there is considerable variation in general appearance, branching, length of internodes and leaves, etc. Taxonomically constant characters are principally furnished by the flowers, fruits and basal leaf sheaths. The number and size of the denticles along the leaf margins is characteristic in many species. It must be pointed out, however, that our understanding of the variation in *Najas* is slight. Identification is primarily based upon the morphology of the male and female flowers, and, because of that, it is impossible in most cases to determine a specimen without flowers. Barren specimens are rather often collected ; in some species flowering branches are only rarely observed. It is probable that many undescribed species still are awaiting discovery.

In the spring of 1951, 13 collections of *Najas* were sent from the Herbarium of The Royal Botanic Gardens to the writer for identification. Two collections represent *species novae*, the others have furnished much information with respect to the taxonomy and distribution of little known forms. The writer is much indebted to his friends and colleagues Dr. G. E. Haglund and Mr. R. Ross for linguistic revisions of the Latin and English text, respectively.

There are 16 species of *Najas* known from the African continent and the Mascarenes. The Madagascar-Mascarenean region is characterized by three endemic species (*N. madagascariensis* Rendle, *N. australis* Bory ex Cham., *N. setacea* (A. Br.) Rendle) as well as by 2 species of a rather wide distribution (see Jumelle, Najadaceae in Flore de Madagascar, 1950). One of the latter, *N. marina* L., is represented in Africa by a stout, strongly spiny form, regarded as a variety by Rendle (Trans. Linn. Soc. (1899) p. 397 ; Pflanzenr. 4 : 12 (1901) p. 8) but recently raised to specific rank (Lindberg fil. in Acta Soc. Sci. Fenn., B, I, 2 (1932) p. 8 ; Täckholm, Fl. of Egypt, I (1941) p. 113). As transitions to *N. marina* are common, however, it is better treated as a subspecies (geographic race)[1]) of the latter : *N. marina* ssp. *armata* (Lindb. f.) n. comb. (*N. muricata* Delile, Fl. Egypte (1813) p. 281, non *N. muricata* Thuillier, Fl. Paris., ed. 2 (1799) p. 509.—*Caulinia muricata* Spreng., Syst. I (1825) p. 20.—*N. marina* var. *muricata* A. Braun ex K. Schumann in Martius Fl. Bras., III, 3 (1894) p. 725.—*N. armata* Lindberg fil., Acta Soc. Sci. Fenn., B, I, 2 (1932) p. 8).

(1) Cf. e.g. Du Rietz in *Sv. Bot. Tidskr.*, *24* (1930) p. 354 and Clausen in *Rhodora*, *43* (1941) p. 157.

This subspecies is found in Palestine, Sicily, Egypt, Algeria, Morocco, British East Africa, and has been recorded from various warm countries in the Old World, *e.g.* Ceylon and Australia. The other non-endemic Madagascan species, *N. pectinata* (Parl.) Magnus, is an exclusively African plant (see p. 38).

Our knowledge of the South African *Najas*-flora is probably very fragmentary. As far as the writer is aware only two species have been recorded from S. Africa, *viz. N. pectinata* and *N. interrupta* K. Schum. ap. Engler.

In tropical East Africa 6 species of *Najas* occur : *N. marina*, *N. pectinata*, *N. interrupta*, *N. graminea*, *N. minor* and *N. schweinfurthii*. *N. interrupta* is known from one locality in British East Africa (Lake Victoria), and also from the Transvaal. It is perhaps only a form of *N. pectinata* and in any case comes very near to it. *N. graminea* Del. has a wide distribution in the Old World tropics (see p. 16). *N. minor* All. is widely distributed in Europe and Asia from France and Italy to Manchuria and Japan. It has been reported from British East Africa and from a number of localities in Egypt, Tunis and Algeria. It is somewhat doubtful, however, whether all records really refer to that species. Finally *N. schweinfurthii* Magnus is a fairly distinct species based on a collection of Schweinfurth in the Bahr El Ghazal Province of the Sudan (Jur) in 1889. It has not been found again.

N. marina, *N. graminea*, *N. pectinata*, and *N. minor* are the species found in North Africa. They are most frequent in the Nile Valley and the Egyptian Oases but become rare westwards.

As regards the species of *Najas*, the flora of West Tropical Africa deviates considerably from those of the other geographic regions of the continent. From the survey above it can be seen that in most areas there are several widespread species and rather few endemics. In the Madagascan region (normally characterized by a very high degree of endemism) there are 2 widespread and 3 endemic species ; in the South African region 2 more or less widespread species ; in Tropical East Africa 5 widespread and 1 endemic species ; in North Africa 4 widespread species. In Tropical West Africa there are, however, 1 widespread (*N. pectinata*) and 7 endemic species (*N. affinis* Rendle, *N. baldwinii* H. af R., *N. hagerupi* n.sp., *N. liberiensis* H. af R., *N. meiklei* n.sp., *N. testui* Rendle, and *N. welwitschii* Rendle) most of them restricted to small areas. The reason why endemism amongst African *Najas* species occurs chiefly in West Tropical Africa is obscure. Nothing quite comparable is known among other aquatic spermatophytes, nor is the West Tropical African flora as a whole characterized by any large degree of endemism.

All species of *Najas* known from the African continent, Madagascar and the Mascarenes have been included in the following key.

1. Dioecious, coarse plants. Anatomy of the stem clearly differentiated into epidermis, cortex, and central cylinder. Internodes and dorsal side of leaves generally armed with spines. (Subgenus *Eunajas*).— North Africa ; Uganda ; Trop. Asia ; Australia ; Palestine ; Sicily. *N. marina* ssp. *armata*

1. Monoecious, slender and delicate plants. In the anatomy of the stem no difference between epidermis and cortex. Internodes and dorsal side of leaves without spines. (Subgenus *Caulinia*).

   2. One or both kinds of flower provided with a spathe enveloping the perianth of the male flower and/or the nude ovary of the female flower.

      3. Both male and female flowers with a spathe (Sectio *Spathaceae*).

         4. Sheaths distinctly auricled.

            5. The upper part of the leaf margin on each side with 5 minute and inconspicuous teeth, lower part devoid of teeth. Sheaths with c. 4 small spines. Male flower c. 4 mm. long, anther quadrilocular. Female flower c. 3 mm. long, neck of spathe being $\frac{1}{3}$ of the total length. Fruit 2·5–3·0 mm. long, testa with c. 25 regular rows of squarish areolae.—Madag., Maur., Réun. *N. madagascariensis*

            5. Each side of the leaf margin with 12–21 teeth, macroscopically visible, and distributed along the whole length of the leaf. Sheaths with 3–10 big spines. Flowers and fruits—so far as they are known—less than 2·5 mm. long.

               6. Leaf margin with c. 12 teeh on each side. At the middle of the leaf, thet length of teeth are c. $\frac{1}{2}$ of the leaf width. Male flower c. 2 mm. long, anther unilocular. Female flower c. 2·25 mm. long, neck of spathe being 1/10 of the total length. Fruits unknown.—Sudan (Bahr El Ghazal). *N. schweinfurthii*

               6. Leaf margin with c. 16 (12–21) teeth on each side. At the middle of the leaf the length of teeth are c. $\frac{1}{5}$ of the leaf width. Male flower c. 1·5 mm. long, anther quadrilocular. Female flower c. 1·8 mm. long, neck of spathe being more than $\frac{1}{2}$ of the total length. Fruits 2·0–2·5 mm. long, testa with about 14 irregular rows of markings.—Nigeria. *N. meiklei* n.sp.

         4. Sheaths broadly rotundate or truncate, never distinctly auricled.

            5. Leaf margin on each side with less than 10 minute and inconspicuous teeth.

               6. Lower part of leaf without teeth. Leaves 15–45 mm. long. Male flower c. 4 mm. long, neck 1 mm., capped with several spines. Markings of the testa squarish (cf. above) (*N. madagascariensis*)

6. Teeth (7–10) distributed along the whole margin. Leaves generally less than 8 mm. long. Male flower c. 2 mm. long, neck 0·5 mm., generally capped with only two spines. Female flower c. 2 mm. long, neck of spathe being $\frac{1}{4}$ of the total length. Fruits c. 2 mm. long, testa with c. 20 rows of hexagonal markings.—Ubangi-Shari. *N. testui*

5. Leaf margin on each side with 12–20 teeth, clearly visible macroscopically.

6. Length of teeth c. $\frac{1}{2}$ of the leaf width at the middle of the leaf. Sheaths with up to 9 teeth, not fimbriate. Intravaginal scales subulate. Male flower c. 3 mm. long. Female flower c. 2 mm. long, without terminal outgrowths. Fruits 2·5 mm. long, provided with about 25 rows of distinct squarish markings.—Angola. *N. welwitschii*

6. Length of teeth c. $\frac{1}{4}$ of the leaf width at the middle of the leaf. Sheaths with more than 10 spines, irregularly fimbriate, sometimes down to the base. Intravaginal scales lanceolate. Male flower c. 2 mm. long. Female flower c. 1·5 mm. long, with two terminal spine-capped outgrowths. Fruits unknown.—Senegal. *N. affinis*

3. Only male flower provided with spathe, female flower nude (Sectio *Euvaginatae*)

4. Sheaths distinctly auricled. At the middle of the leaf, the length of the teeth does not exceed 1/10 of the leaf width. Teeth numerous, more than 20 on each side.

5. Leaves not more than 0·4 mm. wide at the middle. Teeth 20–30 on each side of the margin, but absent from the lower part of the leaf. Auricles broadly triangular. Anther quadrilocular.—Réun. *N. setacea*

5. Leaves up to 0·6 mm. wide at the middle. Teeth 35–45 on each side of the margin, distributed along the whole length of the leaf. Auricles narrowly triangular. Anther unilocular.—French Sudan. *N. hagerupi* n.sp.

4. Sheaths broadly rotundate or truncate. Teeth of the leaf margin large and conspicuous, often exceeding the leaf width in length, but few, less than 20 on each side.

5. Teeth of the leaf margin 12–18 on each side, at the middle of the leaf c. $\frac{1}{3}$ of the leaf width. Sheaths with 10–16 small spines. Fruits with c. 25 rows of squarish markings.—Madag., Maur., Réun. *N. australis*

5. Teeth of the leaf margin generally less than 10 on each side, at the middle of the leaf $\frac{1}{2}$–1/1 of the leaf width or exceeding it. Sheaths with 4–7 spines. Fruits with 10–20 rows of markings.

6. Length of teeth at the middle of the leaf varying between c. $\frac{1}{3}$ and more than 1/1 of the leaf width (0·3–0·5 mm.). Spines of sheath generally strong. Male flower c. 1·5 mm. long, anther unilocular. Fruits with c. 12–18 rows of transverse-elongate ladder-like pits.—Egypt, Tunis, Algeria, Sudan (?); Eur., Asia. *N. minor*

6. Length of teeth at the middle of the leaf 1/1 of the leaf width (0·5–0·8 mm.) or more. Spines of sheath small. Male flower 2·5–3·0 mm. long, anther quadrilocular. Fruits with c. 15–20 rows of squarish markings.

7. Plant large and rigid with strongly falcate leaves. At the middle of the leaf, the length of the teeth generally exceeds the leaf width.—Entire Africa, Madag. *N. pectinata*

7. Plant slender with lax leaves. Length of the teeth generally not exceeding the leaf width at the middle of the leaf.—Tanganyika, Transvaal. *N. interrupta*

2. All flowers without spathes (Sectio *Nudae*)

3. Leaf margin with 30–50 minute teeth on each side. Sheath more than 2·5 mm. long; auricle subulate, about $\frac{1}{2}$ of the total sheath length, bearing about 10 rather prominent spines. Female flower 1·3–1·6 mm. long. Fruits with 25–30 rows of squarish markings.—Egypt, Algeria, Sudan, Abyssinia, Socotra; Old World Tropics; Europe, North America, introd. *N. graminea*

3. Leaf margin with 4–25 teeth on each side. Sheath less than 2·0 mm. long; auricle broadly triangular, $\frac{1}{3}$–$\frac{1}{5}$ of the total sheath length, bearing 0–5 spines. Female flower 1·5–2·0 mm. long.

4. Leaf margin not undulate, with c. 10 minute teeth. Auricle generally bearing 3–5 inconspicuous spines. Fruits 1·6–2·1 mm. long, with 20–25 rows of squarish markings.—Liberia, Tchad Terr. *N. liberiensis*

4. Leaf margin undulate, with c. 20 rather prominent teeth. Auricle characterized by 2 large brownish spines in the apex. Fruits 2·0–2·5 mm. long, with c. 50 rows of elongate markings.—Liberia, Sierra Leone. *N. baldwinii*

Najas meiklei *H. af R.* n.sp. ; *N. schweinfurthii* Magnus affinis, sed spinulis foliorum numerosis, minutis, anthera quadrilocularis, minori, colle spathae femineae longiore differt.

Planta aquatica tenuis, fusco-viridis. *Folia* laxa, linearia, (16–) 25 (–32)[1]) mm. longa, (0·26–) 0·46 (–0·68) mm. lata, apicibus saepius obtusis vel truncatis, bidentatis ; utrinque spinulis minutis, (12–) 16 (–21), 70–100 μ longis, latitudinis laminae quintam partem aequantibus, ± ascendentibus instructa. *Vagina* auriculata, (2·20–) 2·49 (–2·64) mm. longa (auricula inclusa) ; auricula non fimbriata, (0·26–) 0·53 (–0·66) mm. longa (spinulusis inclusis), rotundo-triangularis; margo exterior apexque spinulis 3–10 majoris brunneis ascendentibus, 100–130 μ longis, praedita ; margo interior sublevis. *Flos masculus* (1·21–) 1·38 (–1·87) mm. longus, sessilis vel breviter pedicellatus, spathaceus ; spatha ellipsoidea vel ovoidea, in collum breviter cylindraceum, (0·50–) 0·59 (–0·66) mm. longum, sub ore spinuliferum desinens ; perianthium apice bilabiatum ad antheram quadrilocularem arcte applicatum. *Flos femineus* (unicus observatus) 1·76 mm. longus (stylus cum stigmatibus inclusus), anguste ellipsoideus, spathaceus, stylus cum stigmatibus 1·10 mm. longus ; spatha feminea anguste ellipsoidea collo breviter cylindrico, ore spinifero, subfimbriato. *Fructus* anguste ellipsoideus, subsymmetricus, brunneus, spatha persistente inclusus ; semen (1·91–) 2·13 (–2·45) mm. longum, flavum. Testa in areolis subquadratibus ± irregulariter c. 14-lineata (lineae c. 100 μ latae).

Submerged plant, bushy, copiously branched above the base, dark green. *Stems* up to 20 cm. long, slender, lax, terete, lateral branches up to 5 cm. long, densely leaved above, more sparsely leaved towards the base. Lower internodes up to 40 mm. long, up to 0·6 mm. in diam. ; those from the middle of the stem 10–20 mm. long, to 0·4 mm. in diam. ; upper internodes 5–12 mm. long, 0·3–0·5 mm. in diam. Roots reddish brown. *Leaves* lax, spreading, linear, (16–) 25 (–32) mm. long, at the middle of the leaf (0·26–) 0·46 (–0·68) mm. broad ; apices varying, generally obtuse or truncate and bidentate, sometimes more acute and unidentate ; leaves on each side provided with (12–) 16 (–21) teeth c. 70–100 μ long, supported by two (sometimes very slightly) projecting epidermal cells, making an angle of 30–45° with the leaf margin, brownish, at the middle of the leaf about $\frac{1}{5}$ of the lead width ; libriform cells mostly present, forming an unbroken row below the epidermis. *Intravaginal scales* somewhat varying in shape, generally lanceolate to linear, (0·55–) 0·70 (–0·88) mm. long. *Sheaths* strongly auricled, (2·20–) 2·49 (–2·64) mm. long (includ. auricle), (1·98) 2·32 (–2·42) mm. broad ; auricle (0·26–) 0·53 (–0·66) mm. long (includ. spines), broadly and obtusely triangular, on outer margin and apex bearing 3–10 stout, brownish, upwardly-directed spines (c. 100–130 μ long), inner margin mostly entire, auricle not or only very slightly fimbriate below the spines. *Flowers* on lateral shoots, solitary or some few together, male and female flowers on the same plant, but generally on different branches. *Male flower* (1·21–) 1·38 (–1·87) mm. long, sessile or very slightly stalked, provided with a spathe closely fitting to the perianth and continuing

(1) The three values given for most characters in this description and the following refer to the extreme and mean values of 10 measurements.

Fig. 1. *Najas meiklei n.sp.*—A. Female flower 40/1.—B.C. Male flowers 40/1 The quadrilocular anther cannot be clearly seen in this fixed and stained material, though it is easy to observe in fresh material.—D. Fruit 15/1.—E. Part of testa, showing the irregular areolae 15/1. F. Male flower *in situ* among leaf bases, leaf sheaths, and intravaginal scales 30/1.—G. Sheath 20/1.

[*To face page* 34

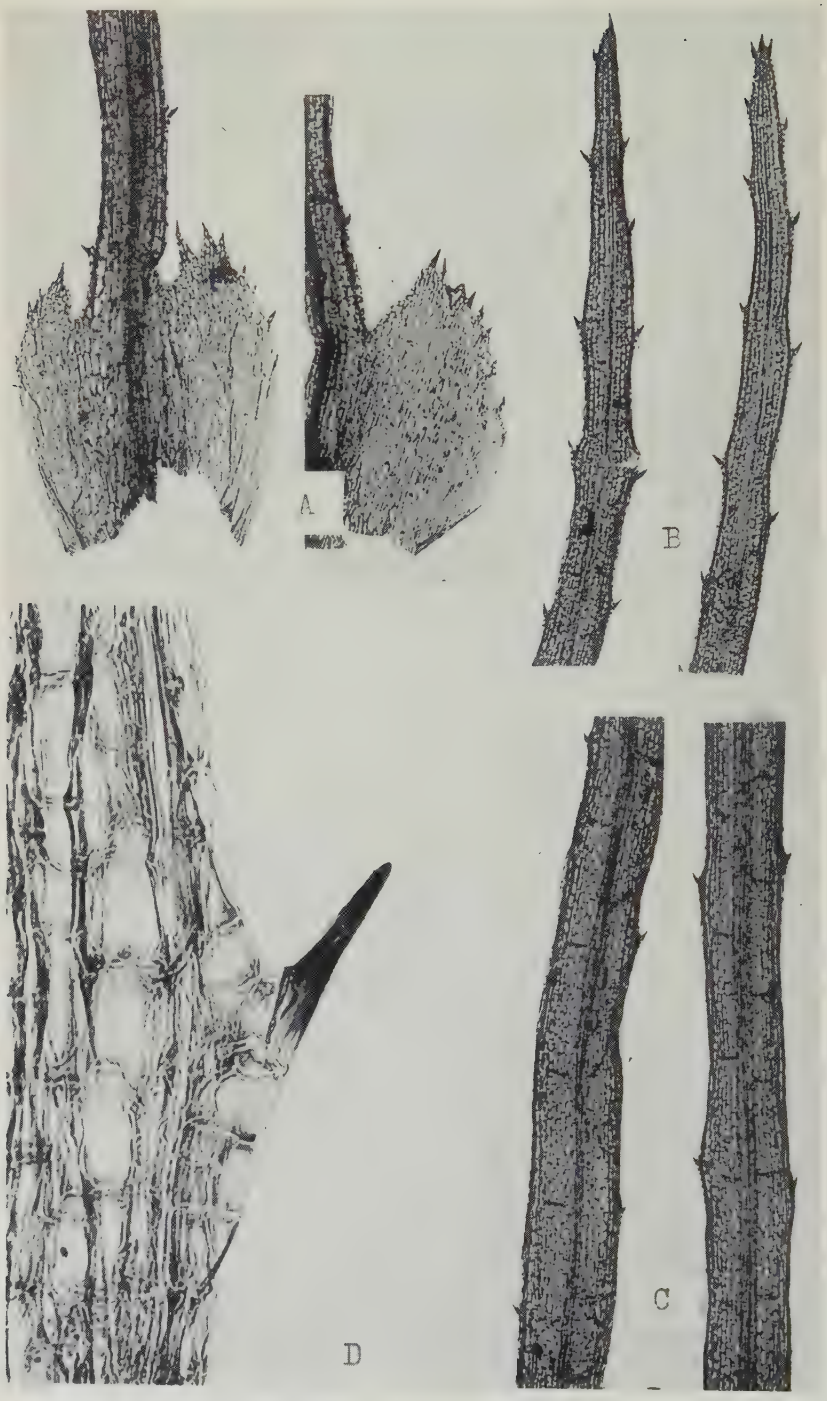

Fig. 2. *Najas meiklei n.sp.*—A. Sheaths 20/1.—B. Leaf tips 20/1.—C. Leaves at the middle 20/1.—D. Detail of leaf denticle, surrounding epidermal cells and libriform cells 325/1.

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above it in a cylindrical neck (0·50–) 0·59 (–0·66) mm. long, ending in 4–7 coarse brownish spines ; perianth slightly bilobed immediately above the anther ; anther containing 4 loculi, symmetrically oblong to ovate. *Female flower* (only one unfertilized female flower observed) 1·76 mm. long (includ. style and stigmas), narrowly elliptic ; the cylindrical style divided into two long linear stigmas, style and stigmas together 1·10 mm. long ; ovule and lower part of style surrounded by a spathe, 0·93 mm. long, at the apex slightly fimbriate and terminated by 12 brownish spines ; the neck of the spathe more than ½ of the total length. *Fruits* solitary or some few together, narrowly elliptic, generally symmetric, sometimes slightly curved ; spathe closely fitting the pericarp and removeable only with difficulty, yellow, its uppermost part forming a fragile beak together with the stigmas ; seed (1·91–) 2·13 (–2·45) mm. long, (0·41–) 0·68 (–0·79) mm. broad, yellow ; testa rather indistinctly marked with about 14 rows of irregular areoleae, c. 100 μ broad.

Nigeria. Minna Division : In stream below Gwari hill near Minna. Rocky stream-bed, in pools 1–2′ deep. 3-XII-1949, *R. D. Meikle* 710 (holotype in Herb. Kew.).

This new species belongs to the section *Spathaceae*, a small, prevalently tropical African section. Besides the three African species dealt with by Rendle in Engler's *Pflanzenreich* (**4** : 12, 1901 : see also Rendle in *Trans. Linn. Soc.* **5**, 1899–1900, Bennett in *Fl. of Trop.* Afr. **8**, 1902, and Hutchinson & Dalziel, *Fl. of W. Trop. Afr.* **2** : 2, 1936) viz. *N. schweinfurthii* Magnus, *N. welwitschii* Rendle and *N. affinis* Rendle, a fourth species, *N. testui* Rendle, was described in 1937 (*Journ. of Bot.*, **75**, p. 51). Three additional species are furthermore known, from Madagascar, India, and Japan, respectively. According to Hutchinson (*Fam. Flow. Pl.*, **2** (1934), p. 51) the *Najadales* represent a very advanced and reduced type of monocotyledon stock. Markgraf, *Ber. Deutsch. Bot. Ges.*, **54** (1936), p. 216, has reached the same conclusions from another starting point. If this phylogenetic interpretation is correct the *Spathaceae*, with respect to their floral morphology, are to be considered as the least advanced and most primitive type within the genus. It may then be of some interest from a phytogeographical point of view that all species belonging to this section are characterized by very small areas of distribution which are much isolated from each other.

The *Spathaceae* are immediately recognized by the spathes enveloping the female flowers. In the other sections of *Caulinia* the female flower consists only of an ovary. The five African members are superficially much alike. They are small, slender plants with narrow, spreading leaves and are generally regularly branched. *N. meiklei* is most nearly allied to *N. schweinfurthii* and to *N. affinis*. For differences, see the description and the key.

Najas hagerupi *H. af R.* n.sp. ; *N. kurzianae* Rendle affinis, sed foliis latioribus, spinulis foliorum numerosioribus, auriculis anguste triangularibus differt ; a *N. pseudograminea* Walo Koch foliis angustioribus, auriculis vaginisque brevioribus cum spinulis 2–5 instructis differt.

Planta aquatica fragilis, gracillima, brunneo-viridis. *Folia* subrigidula, recurvata, (15–) 19 (–25) mm. longa, medio folii (0·44–) 0·57 (–0·)66

mm. lata, apicibus obtusis, bidentatis vel tridentatis ; utrinque spinulis minutissimis, 25–35 μ longis, pernumerosis (34–) 40 (–43), latitudinis laminae decima parte minoribus, ascendentibus obsita. *Vagina* fortiter auriculata, (1·54–) 1·66 (–1·82) mm. longa (auricula inclusa) ; auricula non fimbriata (0·44–) 0·53 (–0·64) mm. longa (spinulis inclusis), anguste triangularis ; margo exterior apexque spinulis 2–5 brunneis, ascendentibus, c. 70–110 μ longis, ornata ; margo interior normaliter laevis. *Flos masculus* (1·19–) 1·30 (–1·43) mm. longus, sessilis vel breviter pedicellatus, spathaceus ; spatha ovata, in collum breviter cylindraceum, (0·42–) 0·47 (–0·55) mm. longum, sub ore spinuliferum desinens ; perianthium ad antheram unilocularem arcte applicatum. *Flos femineus* (tres observati, haud maturi) 1·00–1·32 mm. longus (stylus cum stigmatibus inclusus), ellipsoideus, nudus, stylus cum stigmatibus 0·42–0·66 mm. longus. *Fructus* ignotus.

Submerged plant, copiously branched, as preserved brownish green Only upper half of plant seen. *Stems* slender, terete or subterete, latera branches up to 5 cm. long, densely leaved above, more sparsely towards the base. Internodes (only upper ones seen) 8–11 mm. long, 0·3–0·5 mm. in diam. *Leaves* somewhat rigid, generally recurved, (15–) 19 (–25) mm. long, at the middle of the leaf (0·44–) 0·57 (–0·66) mm. broad, greenish, middle nerve of a peculiar, rather distinctive, violet colour ; apices generally obtuse, bidentate or tridentate ; leaves on each side provided with (34–) 40 (–43) very small teeth, 25–35 μ long, supported by two epidermal cells which project very slightly or not at all, making an angle of 30 -45° with the leaf margin, brownish, at the middle of the leaf less than 1/10 of the leaf width ; libriform cells absent. *Intravaginal scales* generally linear, (1·32–) 1·43 (–1·76) mm. long. *Sheaths* strongly auricled, (1·54–) 1·66 (–1·82) mm. long (includ. auricle), (1·32–) 1·52 (–1·76) mm. broad ; auricle (0·44–) 0·53 (–0·64) mm. long (includ. spines), more or less narrowly triangular, on outer margin and apex bearing 2 5 upwardly-directed, brownish spines (c. 70–110 μ long), inner margin entire, sometimes a single tooth on the lowermost part, auricle not or only very slightly fimbriate below the spines, formed of an extremely delicate, colourless cell-tissue. *Flowers* on lateral shoots, solitary or some few together, male and female flowers on the same plant, but generally on different branches. *Male flower* (1·19–) 1·30 (–1·43) mm. long, sessile or very slightly stalked, provided with a spathe closely fitting to the perianth and continuing above it in a cylindrical neck, (0·42–) 0·47 (–0·55) mm. long, ending into 3–4 brownish spines ; anther so far as can be ascertained unilocular, ovate. *Female flower* (only 3 somewhat immature female flowers observed) 1·00, 1·17 and 1·32 mm. in length (includ. style and stigmas), elliptic, devoid of spathe ; the cylindrical style divided into two long linear stigmas, style and stigmas together 0·42, 0·53, and 0·66 mm. long, respectively. *Fruits* unknown.

French Sudan. Niger Military Territory : Gao, 17th Sept., 1927, *O. Hagerup* 368 a (holotype in Herb. Kew.).

The type material is rather scanty and entirely devoid of fruits. Search for additional material in the Copenhagen University Herbarium has yielded no success (*fide* Dr. O. Hagerup *in litt.* May 1951). The plant collected by Hagerup in Gao stands rather isolated in the African *Najas* flora. It cannot be identified with any known African species of *Najas*.

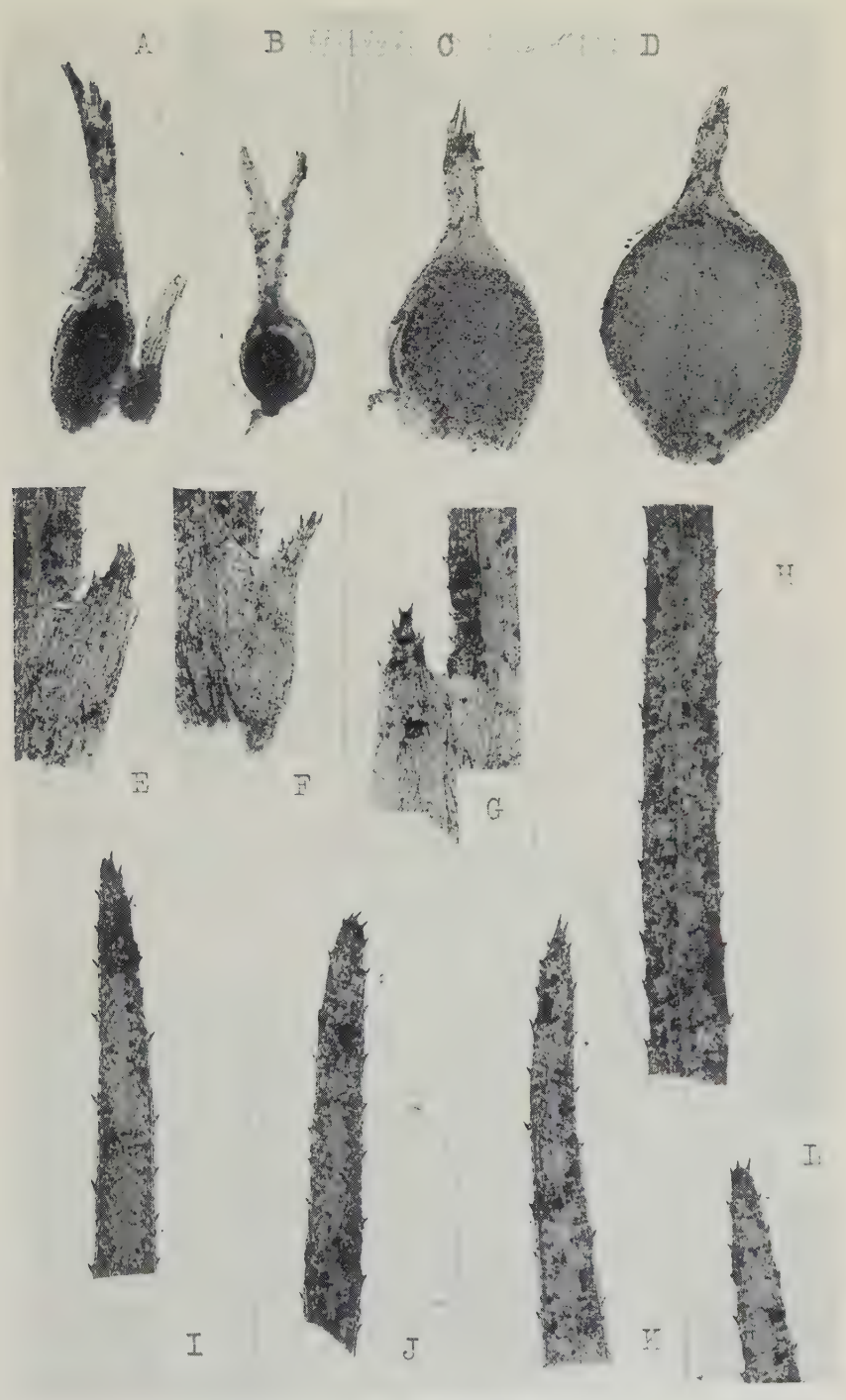

Fig. 3. *Najas hagerupi n.sp.*—A–B. Female flowers 40/1. C–D. Male flowers 40/1.—E–G. Sheaths 20/1.—H. Leaf at the middle 20/1.—I–L. Leaf tips 20/1.

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N. hagerupi belong to the section *Euvaginatae*, characterized by spathaceous male flowers, nude female flowers, and truncate or auriculate sheaths. Within this section, it is to be referred to a group of eleven species, all with strongly auricled sheaths as a distinctive feature. *N. hagerupi* differs from the other members of this group (except *N. kurziana*[1]) by its unilocular anther. Regardless of this character, these species may be divided into two subgroups, one in which the leaves are provided with very numerous (24–25) minute and inconspicuous teeth on each margin (*N. kurziana* Rendle, *N. setacea* (A. Br.) Rendle, *N. pseudograminea* Walo Koch), the other with less numerous denticles (6–25), which may be rather prominent. To this latter assemblage belong *N. gracillima* (A. Br.) Rendle, *N. lacerata* Rendle, *N. foveolata* A. Br. ex Magnus, *N. falciculata* A. Br., *N. brevistyla* Rendle, *N. tenuifolia* A. Br., *N. browniana* Rendle, and *N. leichhardtii* Magnus. *N. hagerupi* is definitely to be classed with the three interesting " pseudograminear " species of the first subgroup. A survey of some of their distinctive characters has been attempted in the table below. It must be emphasized, however, that no material of *N. pseudograminea* has been examined.

	N. hagerupi	*N. kurziana*	*N. setacea*	*N. pseudograminea* acc. to Koch, Ber. Schweiz. Bot. Ges., 44 (1935) p.339
Leaf width at middle ...	0·4–0·6 mm.	0·3–0·4 mm.	0·3–0·4 mm.	0·9–1·0 mm.
Length of teeth in proportion to width of leaf at middle	< 1/10	c. 1/10	c. 1/10	< 1/10
Number of teeth	35–45	20–30	20–30	35–45
Length of sheath	1·5–1·8 mm.	c. 1·5 mm.	c. 1·8 mm.	1·9–2·6 mm.
Shape of auricles ...	narrowly triangular	low, rounded, broadly triangular	low, rounded, broadly triangular	narrowly triangular to almost subulate
Number of spines on auricle	2–5	4–5	4–5	7–12
Length of male flower ...	c. 1·3 mm.	c. 1·0 mm.	male flowers unknown	?
Anther	1–1oc.	1–1oc.		?
Length of female flower ...	c. 1·2 mm.	c. 1·0 mm.	c. 2·0 mm.	?

A difference which does not appear from the above survey is furnished by the auricle length : in *N. hagerupi* it is c. 0·4–0·6 mm., in *N. pesudograminea* 0·7–1·0 mm. *N. hagerupi* comes rather close to this latter Javan species. It also resembles considerably *N. kurziana*, described from a single locality in northern Bengal. Our plant appears to differ from

(1) In the description of *N. pseudograminea* the number of loculi in the anther is not given.

both by distinctive characters. It is to be noted, however, that up till now only scanty material of the species discussed has been collected and their variation is probably insufficiently known.

Najas pectinata (*Parlatore*) *Magnus* in Ascherson & Schweinfurth, Illustr. Fl. Egypte (1889) p. 145.—*Caulinia pectinata* Parlatore, Fl. Ital., 3 (1858) p. 665.—*N. horrida* A. Braun ex Magnus, Beitr. z. Kenntn. d. Gattung Najas (1870) p. 46.

Anglo-Egyptian Sudan : Bahr el Ghazal, 5-III-1930, *N. Douglas Simpson* 7631.—Uganda : Entebbe in Lake Victoria, XII-1937, *Chandler* 2071 B ; Bungugu, Junje, XII-1937, *Chandler* 2071 A.—Kenya : Naiwasha Lake, 1-V-1932, *E. R. Napier* 1845.—Tanganyika Terr. : Western Usambaras, Kalambo, 7-V-1935, *Greenway* 4056.—Bechuanaland : Niangana, Okawangobucht, V-1934, *Dibter* 7264.

This is the common species of *Najas* in tropical Africa. It has the widest distribution on the continent, and seems to exceed other species also in frequency. It ranges from north-eastern outposts in Egypt (Nile Delta : Shirbin, and Nile Valley : Madinet el Faiyum), through the Sudan (Fung, White Nile and Bahr el Ghazal Provinces) and tropical East Africa (it seems to be especially common here, numerous localities are known from Uganda to Mozambique) and extends into South Africa and Madagascar. In West Africa, this species has been found in Algeria, Senegal, Nigeria, and the Cameroons.

Generally, *N. pectinata* is rather easy to identify at a superficial examination. Its characteristic straggling habit, the coarse teeth mostly exceeding the leaf width in length, and the fairly characteristic male flowers make it not very easily mistaken for any other African species. *N. pectinata* is characterized by a rapid and vigorous vegetative growth, and for that reason it has become an important noxious waterweed in tropical Africa. In this respect it surpasses most paleotropical species of *Najas*. Linked with the vegetative propagation is a comparatively weak sexual reproduction. Many of the collections in herbaria are devoid of flowers and fruits.

Najas interrupta *K. Schumann* in Engler's Pflanzenwelt Ost-afrikas, **C** (1895) p. 94.

Transvaal : *J. H. McLea*, Herb. Bolus 6283.

This species was described briefly by Schumann on material from Lake Victoria. In 1897 Bennett (Fl. Capens. 7, p. 51) referred the Bolus collection to Schumann's species. Detailed descriptions were given by Rendle (Trans. Linn. Soc. 5 (1899) p. 423 and Engler's Pflanzenr., 4 : 12 (1901) p. 17).

The Bolus material is rather fragmentary. No male flowers have been observed. In Rendle's description only empty male spathes were mentioned ; whether they belonged to this collection or to the type was not ascertained. The writer has had no possibility of examining the type collection (Fischer 614).

To judge from the published descriptions and from the material collected by McLea, *N. interrupta* comes very near to *N. pectinata*. The

difference between these species is said to be that *N. interrupta* is characterized by teeth " laminae latitudinem haud excedentes ", while the teeth in *N. pectinata* are longer than the width of the leaf. In the Bolus collection, the interior marginal teeth usually are of the same length as the width of the blade. But, in *N. pectinata*, weak forms are sometimes met (e.g. *Napier* 1845 from Kenya) which are practically indistinguishable from the Transvaal material of *N. interrupta*.

The final decision as to whether this species is taxonomically tenable must wait, however, until its type has been examined.

Najas graminea *Delile*, Fl. Egypte (1812) p. 282; Rendle in Engler's Pflanzenr. 4 : 12 (1901) p. 18 cum synonymis sed exclus. varietatis.

Anglo-Egyptian Sudan : Bahr el Ghazal, Jur, Kutshuk Ali's Zariba, 5-V-1869, *G. Schweinfurth* 1717.

The occurrence of *N. graminea* in Jur represents one of the westernmost spontaneous localities of that species. *N. graminea* has a wide distribution in the Old World tropics from Japan and New Caledonia to Algeria, Egypt, and Sudan (map in Horn af Rantzien, Medd. Göteb. *Bot. Trädg.*, 18 (1950) p. 192). It has been introduced into Europe (England, Italy, Bulgaria) and recently into U.S.A. (California in a rice-field 1949 acc. to inf. *in litt.* from H. L. Mason, Univ. of Calif., Dec. 1, 1950). In Africa this species is restricted to the northern and eastern parts, Algeria, Egypt (numerous localities), Abyssinia, Socotra and the Anglo-Egyptian Sudan (Kordofan ; White Nile and Bahr el Ghazal Provinces).

N. graminea is often recognized in the field by its very lax, almost " graminoid " appearance and the long leaves which are minutely toothed by numerous denticles. When examined microscopically it is immediately identified by the absence of spathes in both the male and female flowers. As well as in *N. graminea*, nude male flowers are found in a probably distinct Indian form (*N. bengalensis* H. af R.) and in the two species discussed below.

By its vigorous growth this species has become an important weed in the irrigation channels of Egypt and in rice-fields on some of the Indonesian islands.

Najas liberiensis *Horn af Rantzien*, Medd. Göteb. Bot. Trädg., **18** (1950) p. 190.

Tchad Territory : Haut Chari, Dar Banda entre El Koukoura et El Kago Dje, 4-XII-1902, *Aug. Chevalier* 6582.

Up till now this species was known only from the type locality in Liberia (Vonjama, *Baldwin* 9925). In the type collection no quite mature female flowers are to be observed. For that reason the measurements given in the description were considerably too small. Three fully developed female flowers in the present collection range between 1·76 mm. and 1·98 mm. in length.

Though the Chari plant corresponds rather well with the type collection in respect of all important characters, there are some small differences which would eventually merit its distinction as a variety. Thus the leaves tend to be a little narrower, generally about 0·30 mm. at the middle

(type : *c.* 0·40 mm.) and the auricles are provided with somewhat stronger teeth, 4–6 in number.

N. liberiensis is a small, slender plant, in its general appearance, leaves, and sheaths much more similar to the species of the section *Spathaceae* than to *N. graminea*. With regard to the floral morphology it is a close ally of the latter species, however. The two localities known for *N. liberiensis* are situated at a considerable distance from each other and it may have a rather wide distribution in West Tropical Africa.

Najas baldwinii *Horn af Rantzien*, Medd. Göteb. Bot. Trädg., 18 (1950) p. 187.

Sierra Leone : near Njala in backwash of shallow stream at edge of rice swamp, 23-IX-1933, *F. C. Deighton* 2797.

This plant corresponds closely to the type of the species (Liberia, Gondolahun, *Baldwin* 10116). It is somewhat coarser, however, more regularly branched and is provided with longer and somewhat broader leaves than the type. The characteristic bicuspidate auricles are not quite so extreme and uniform as in the latter.

N. baldwinii is a fairly characteristic plant. In its appearance it is rather unlike both *N. liberiensis* and *N. graminea*, to which it is most closely allied.

In addition to the new Sierra Leone locality and the type locality in the Western Prov. of Liberia, *N. baldwinii* has been found in the Salala Distr. in the Central Prov. of Liberia, where it was collected by J. T. Baldwin Jr. in 1949 on his second journey to West Tropical Africa (*Baldwin* 13206). In every character, the latter plant is almost identical with the type (Horn af Rantzien, Botaniska Notiser 1951 : 4).

A new British Clavaria.

Dr. J. Colhoun of Queen's University, Belfast, recently presented to Kew a small collection of *Clavaria taxophila* (Thom) Lloyd, obtained amongst dead leaves on a lawn under a yew tree, Ballydrain House, Dunmurry, Co. Antrim. This is a North American species not hitherto recorded in Europe. *Clavaria mairei* Battetta, described from France, is similar but has subglobose spores 4·5 × 5 μ and hyphae 10–12 μ wide. The spores of the Belfast collection measure 3·5–4 × 2–2·5 μ and its hyphae are mostly 3–5 μ wide. Vermiform gloeocystidia are abundant but project little beyond the basidia.

R. W. G. Dennis.

MARINE ALGAE FROM THE GOLD COAST : IV

C. I. Dickinson.

Dictyota bartayresiana *Lamour.* in Journ. de Bot. **2** : 43 : 1809.

Sekondi, Dec. '49, Prampram, Nov. '48.

The large form grows in rock pools, the small one on the edge of rocky ledges. The plants assigned to this species show two distinct facies. One type collected in the Prampram area grows to about 12 cms. in height and is not more than 3 mm. broad at the widest points just below the bifurcations. The other type from Sekondi grows in entangled mats and is characteristic of the vegetation of exposed situations. These latter are short plants usually of about 2–3 cms. in length and are up to 5 cm. in the widest part of the frond. The two forms agree with those shown in plates XII and XIII of Vickers Phycologia Barbadensis.

Dictyota ciliata *J. Ag.* in Linnaea **15** : 5 : 1841.

Prampram Jan. '46, March '49, ♂ ♀, April '41, Jan. '49.

Growing in sandy pools in the Middle Zone.

Fully grown plants are brown or olive brown ; they reach a length of 18 cms. and are 10–12 mms. in the widest parts. Many of the plants are ciliate but to varying degrees and some have almost entire margins. These Gold Coast plants are for the most-part broader than typical *D. ciliata* but they range from 4 mms. to 8 mms. in width. Non ciliate plants might be mistaken for *D. dichotoma* but *D. dichotoma* is somewhat translucent by comparison.

Sphacelaria elliptica *Dickinson*, sp. nov. Plantae caespitosae, 1·5–2·5 cms. altae, e basi sparse ramosae, parte superiore saepe irregulariter

Fig. 1 *Sphacelaria elliptica* Dickinson. A & B. Portions of filaments bearing propagula. C. Portion of a branching filament × 160. D. A propagulum germinating in situ × 160.

ramosa. Filamenta 50–70 μ lata, segmentis 30–40 μ longis. Rhizoidei breves, crassi. Propagula late elliptica usque 120 μ lata. Pedicellis 5–8 cellulis.

Winneba, Feb. '51, Teshi, Feb. '51, Coll. G. W. Lawson.

Typus in Herb. Kew.

Forming spherical tufts 2 ins. in diameter in the *Lithothamnion* Zone just above the Sargassum.

The affinity of this species is with the little known *Sphacelaria brachygonia* which Gaudichaud brought back from Brazil after his voyage round the world in the " Bonite ". Sauvageau who examined the type considered the species distinct from *S. tribuloides* with which some authors had united it. To judge from Sauvageau's illustrations it seems clear that *S. brachygonia* cannot be regarded as a form of *S. tribuloides* ; the shape of the propagula in the two species is quite different. In *S. brachygonia* they are spindle-shaped as against the more usual tricorn shape of *S. tribuloides*.

Sphacelaria elliptica agrees with *S. brachygonia* in macroscopic appearance, in the proportion of the segments which are shorter than their breadth, and in the type of propagulum. It differs in having long pedicels (2–3 cells in *S. brachygonia*), in the shape of the young propagulum, and in the more broadly elliptical shape of the mature propagulum.

Gelidium elminense *Dickinson*, sp. nov. Plantae usque 6 cms. altae, compressae, parte thalli superiore pinnato-ramosa ; rami basin versus

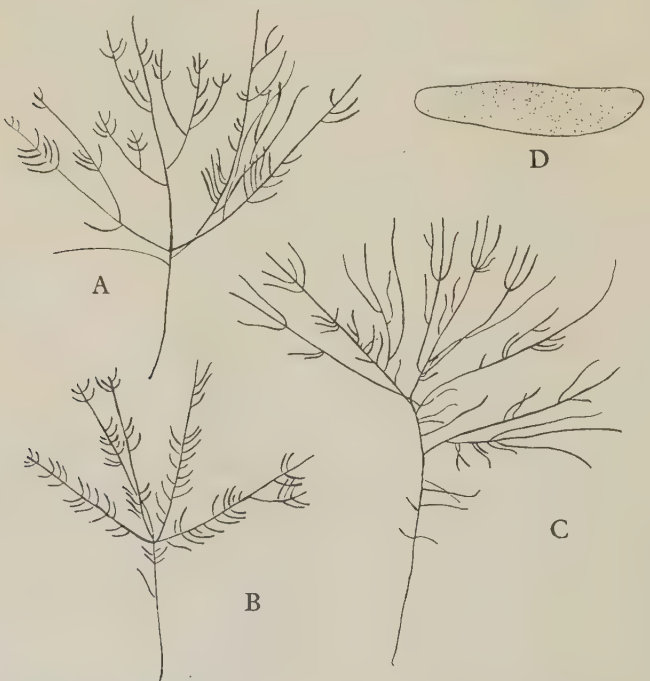

Fig. 2 *Gelidium elminense* Dickinson. A, B, C. Portions of three plants × 1. D. Transverse section of the middle part of the thallus × 100.

attenuati, usque 300 μ lati. Tetrasporangia ad thalli apicem in soris usque 1 mm. longis agglomerata.

Elmina Apr. '45, ⊕ Iture, Apr. '45, ⊕. Typus in Herb. Kew.

On rocks exposed at low tide.

Most algologists are confronted from time to time by a baffling array of Gelidiums and the best one can do is to pick out the homogeneous groups and leave the rest for the attention of people who are able to work amongst the living plants. This genus is well represented on the Gold Coast but so far it has been impossible to resolve it into its component parts. In a recently published paper by Dangeard two new species are described from Dakar but neither can be recognised in this collection. *D. elminense* is with some reluctance described as new after tedious searching into the ever increasing number of *Gelidium* species.

The ultimate branches in this species are commonly 3·5 cm. long and tend to occur in tufts at intervals along the main branches, but the species varies considerably. The three specimens illustrated are from one gathering and *fig. c* shows how the ramuli may increase in length to produce a ragged looking plant which in a more extreme form than the one figured here is hardly recognisable as belonging to the type shown in *fig. a*. Characteristic but not entirely constant is the simple unbranched form of the lower third of the frond.

The tetrasporangial sori occupy about 1 mm. at the tips of the fronds ; the arrangement of the tetrasporangia is quite irregular and there is no appreciable sterile margin.

Gelidium crinale (*Turn.*) *Lamour.* in Bory Dict. class. **7** : 191 : 1825.

Prampram Nov. '49.

On rocks in the Inner Zone.

This is unmistakable *G. crinale*, a delicate looking plant with a terete thallus about 250 μ in diameter, and with branches tapering slightly to the apex but not towards the base. It is a true *Gelidium* having a single apical cell and rhizinae in the inner cortex.

Pterocladia capillacea (*Gmel.*) *Born. et Thur.*, Notes Algol. 57 : 1876.

Prampram, Oct. '41, Winneba, Dec. '49.

On the edge of rock pools in the Outer Zone.

Dasya pedicellata *Ag.*, Syst. Alg. 211 : 1824.

Dredged off Acra 2 miles from the coast at a depth of about 10 fathoms. Feb. '51 ♀, ⊕.

Plants and Animals in Hong Kong. One usually thinks of Hong Kong as one of the great business centres of the Far East. As a port and an exchange market and, nowadays, as one of the few links between China and the West it is well known to the general public. Probably only a minority of even professional biologists are aware that Hong Kong, the island and the mainland Territories, has a most interesting flora and fauna. Dr. G. A. C. Herklots was for some twenty years Reader in Biology in the University of Hong Kong. The book* he has written is full of first hand information regarding the plants, mammals, birds, reptiles, and invertebrates of Hong Kong. It is by no means a textbook though from its pages there could be compiled an adequate summary of many of the important facts concerning the plants and animals of the colony.

Dr. Herklots first describes the organisms of the countryside month by month from January to December. His account is enlivened by anecdotes and personal reminiscences. There is much valuable information regarding the plant life, especially that of an ecological nature. An account of special plant groups is given under the heads of oaks, figs and banyans, palms, wild spices, edible wild fruits, gall nuts, poisonous plants, parasites, mistletoe, insectivorous plants, and water ferns. There is a useful list, with biographical information, of early European botanists in South China and in Hong Kong. An outline of walks and climbs is given in half-a-dozen pages.

The book is excellently illustrated by both coloured and black and white plates and also by many text figures. Most of the illustrations are the work of the author himself. The majority are serios and accurate, a few are whimsically amusing and add to the lively atmosphere of a charming book. There is an index but it is unfortunate that no map is provided.

W. B. Turrill

Essential Oils†—Schimmel's well known "annual reports on essential oils" have now been issued for over half a century and during this period have contributed much to our knowledge of this important group of economic plant products. The present number, published in New York, maintains the high standard set by its predecessors and contains up-to-date information on a wide range of volatile oils and on aromatic chemicals and related materials. Apart from the general treatment of individual essential oils there are short articles on such subjects as :—Sources of Essential Oils, Biogenesis of Essential Oils, Methods of Analysis, Antibiotic Activity of Essential Oils and Odor Perception. A number of good photographs are included, also a bibliography and index.

F. N. Howes.

*G. A. C. Herklots, The Hong Kong Countryside, The South China Morning Post, Ltd. 1951.

†Annual Report on Essential Oils, Aromatic Chemicals, and Related Materials 1947–48. Schimmel & Co., Inc., 601 West 26th Street, New York, 1, N.Y. Pp. 125.

A CONTRIBUTION TO THE BRYOPHYTIC FLORA OF THE NEARER EAST.

JANE TAYLOR.

During the past two decades a considerable number of collections made in the Balkan Peninsula and in Cyprus have been received at Kew. Several of these have included specimens of mosses and liverworts. Since our knowledge of the bryophytic flora of the Nearer East is not great, a list of the specimens of this group of plants collected by H. G. Tedd, by A. W. Hill, N. Y. Sandwith and W. B. Turrill, and by W. B. Turrill in the Balkan Peninsula, and by E. W. Kennedy in Cyprus is published here.

The list comprises 128 moss species and varieties and eleven hepatics. Taking 22° east longitude as an east-west division of the region, a number of species though previously recorded from the western portion appear to be recorded for the first time from the eastern section. Several, namely *Tortula obtusifolia*, *Bryum duvalii*, *Munium punctatum* and *Hypnum fertile* are apparently new to the Nearer East, though this extension of their distribution is of no great phytogeographical significance.

The following are the more noteworthy results of previous bryophytic workers in the Nearer East ; Baumgartner (1943) records 177 moss species and varieties and 28 hepatics in Rechinger's Flora Aegaea while for Crete alone (in a separate paper) he records just over one hundred moss species and varieties and 27 hepatics. Latzel (1931) records some three hundred moss species and varieties for Dalmatia. This work with a phytogeographical approach is more detailed than the purely though necessary systematic listing of the other workers. Markgraf (1928) gives a somewhat meagre total of twelve mosses and three hepatics for Albania. Szepesfalvi (1932) records 65 mosses, eleven liverworts and eight sphagnums in Bulgaria while Vilhelm (1923) adds 67 mosses and five hepatics to the previous records of Breidler (1886), Höhnel (1893, 1894), and Baumgartner (1914) for Montenegro.

The appended systematic list compares favourably with the above in its total recordings, and adds to our knowledge of bryophyte distribution especially in the Thracian localities though obviously a great deal yet remains to be done in the basic collecting of species.

Those species marked with a single asterisk are, so far as is known, new records for their respective localities and the region east of 22° longitude, while a double asterisk denotes a first record for the Nearer East. To a minor degree, the relative frequency of certain species can be judged by the number of recorded stations. The accompanying notes are given in the following order –habitat, altitude, locality, date of collecting, collector (or collectors) and number.

SYSTEMATIC LIST

Musci

[Nomenclature and systematic arrangement follows that of Mönkemeyer.]

EUBRYINALES

Fissidentales

Fissidens taxifolius (*L.*) *Hedw.*

On soil of deeply shaded bank in side valley, c. 400 feet, Xanthi–Shahin road, Thrace, 23-1-36, *Tedd* K. 171.

Fissidens cristatus *Wils.*

Shady places, which face north, among rocks and bushes, c. 800 feet, hills near Xanthi, Thrace, 25-11-33, *Tedd* K. 57.

Fissidens bryoides. (*L.*) *Hedw.*

Steep, deeply shaded earth bank of side valley, c. 400 feet, Xanthi–Shahin road, Thrace, 18-12-35, *Tedd* K. 161.

Dicranales

Pleuridium sp. (sterile).

Gravelly soil on sloping ground among bushes of *Quercus coccifera*, c. 500 feet, Kizildja Mursaal, Thrace, 11-1-34, *Tedd* K. 88.

***Dichodontium pellucidum** (*L.*) *Schpr.*

Tufts among rocks at sheepfold, c. 4000 feet, Kartal Dagh, Thrace, 2-7-36, *Tedd* K. 186.

Dicranum scoparium (*L.*) *Hedw.*

Cushions on humus at roots of trees, etc., common, c. 2000 feet, near Demirdijk, Thrace, 3-33, *Tedd* K. 43. Slopes of Athos peak, high above Lavra, Athos Peninsula, South Macedonia, 20-4-34, *Hill, Sandwith and Turrill* 2818. In woods, c. 800 feet, Atmadjali, west Thrace, 24-3-35, *Tedd* K. 156.

Leucobryum glaucum (*L.*) *Schpr.*

Demirdjik, west Thrace, 5-9-35, *Tedd* K. 158.

Pottiales

Encalypta vulgaris (*Hedw.*) *Hoffm.*

Crevices and niches in calcareous rocks, c. 400 feet, Xanthi-Shahin road, Thrace, 8-12-33, *Tedd* K. 63.

***Encalypta rhabdocarpa** *Schwaegr.* var. **pilifera** *Funck.*

Tree stumps, c. 800 feet, Ketcheli, west Thrace, 24-2-35, *Tedd* K. 137.

Encalypta contorta (*Wulf.*) *Lindb.* K. 4.

Among rocks, near Xanthi, Thrace, 12-30–2-31, *Tedd* K. 4. On rocks, Mt. Lovcen, Montenegro, 15-4-35, *Turrill* s.n. In shade of small bushes of beech in a small ravine, c. 2200 feet, Karpouz Tepé near Xanthi, Thrace, 11-10-36, *Tedd* K. 188.

***Weisia microstoma** (*Hedw.*) *C. Mull.*

Earthy bank under pine trees in a river gully, c. 4100 feet, Kryos, Potamos, Cyprus, 4-2-37, *Kennedy* 26.

Weisia tortilis (*Schwaegr.*) *C. Mull.*

Among stones of the wall of a bridge facing north, c. 500 feet, Xanthi–Shahin road, Thrace, 17-4-35, *Tedd* K. 145. Crevices of limestone rocks, Nestos valley, Thrace, 21-11-37, *Tedd* K. 210.

Weisia viridula (*L.*) *Hedw.*

On rocks, c. 700 feet, near Isidja, Thrace, 7-1-34, *Tedd* K. 86.

Weisia sp. (barren).

Vertical water " drip ", c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 20. Det., C.V.B. Marquand.

Gyroweisia tenuis (*Schrad.*) *Schpr.*

Near Stravronikita, Athos Peninsula, South Macedonia, 21-4-34, *Hill Sandwith* and *Turrill* 2824.

Gyroweisia reflexa *Schpr.*

On inner wall of a disused lime kiln, c. 400 feet, Xanthi–Shahin road, Thrace, 8-12-33, *Tedd* K. 65.

Eucladium verticillatum (*With.*) *B.Y.S.*

Above Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill, Sandwith* and *Turrill* 2802. On granite rock ' slide ' in small stream of a rocky ravine, above Sakarka, Thrace, 16-1-38, *Tedd* K. 232.

Trichostomum crispulum *Bruch.*

Earth in oak wood, c. 2000 feet, near Demirdjik, Thrace, 7-4-34, *Tedd* K. 112 A. On rocks, small islet of Prygos, Athos Peninsula, south Macedonia, 15-4-34, *Hill, Sandwith* and *Turrill* 2820. Crevices in limestone rock, c. 600 feet, Xanthi–Shahin road, Thrace, 17-4-35, *Tedd* K. 155.

Tortella nitida (*Lindb.*) *Broth.*

Ombla valley, Dalmatia, 17-4-35, *Turrill*, s.n.

Tortella flavovirens (*Bruch.*) *Broth.*

On limestone rock at sea level, Kyrenia, Cyprus, 29-10-36, *Kennedy* 31.

Tortella tortuosa (*L.*) *Limpr.*

Non-calcareous rocks, c. 600 feet, Xanthi–Shahin road near Macaclar, Thrace, 14-12-33, *Tedd* K. 67. In crevices of rock and stone, c. 1500 feet, near Kozlondja, Thrace, 11-11-34, *Tedd* K. 126. Nanos, Monte Re, Karst, 24-4-35, *Turrill* s.n.

Pleurochaete squarrosa (*Brid.*) *Lindb.*

Non-calcareous rocks, c. 600 feet, Xanthi–Shahin road, Thrace, 4-1-34, *Tedd* K. 80. On stones by spring, c. 800 feet, near Ketcheli, west Thrace, 22-2-35, *Tedd* K. 153. Near Trebinje, Hercegovina, 18-4-35, *Turrill* s.n.

Barbula convoluta *Hedw.*

Turfy places by path, c. 600 feet, Xanthi–Shahin road, Thrace, 17-4-35, *Tedd* K. 150.

Barbula unguiculata *Hedw.*

Crevices of calcareous rocks, c. 500 feet, Xanthi–Shahin road, Thrace, 9-12-33, *Tedd* K. 78. In crevices of calcareous rocks, c. 700 feet, Kizildja Mursaal, Thrace, 11-1-34, *Tedd* K. 91. On clay over sand subsoil, grassy banks, near Inhauli, Thrace, 13-1-34, *Tedd* K. 94. In crevices of a wall facing north, c. 800 feet, near Ketcheli, west Thrace, 21-2-35, *Tedd* K. 140. On rocks and sandy soil, c. 800 feet, near Ketcheli, west Thrace, 24-2-35, *Tedd* K. 134. Amongst stones and in rock crevices, c. 800 feet, Atmadjali, 3-3-35, *Tedd* K. 139. Near Duzi, west of Trebinje, Hercegovina, 18-4-35, *Turrill* s.n. On wall, Xanthi–Shahin road, Thrace, 26-12-35, *Tedd* K. 135. On stones in woodland, c. 500 feet, below Atmadjali, Thrace, 14-3-37, *Tedd* K. 213.

Barbula fallax *Hedw.*

On stones by side of stream, c. 800 feet, near Emirli, Thrace, 7-1-34, *Tedd* K. 87.

Tortula atrovirens (*Sm.*) *Lindb.*

Rock crevices, c. 600 feet, Xanthi–Shahin road, Thrace, 4-1-34, *Tedd* K. 116. On rock, c. 3100 feet, south of Phiun, Cyprus, 3-1-37, *Kennedy* 4.

****Tortula obtusifolia** *Schleich.*

Shady limestone rocks, c. 2500 feet, valley of the Kryos Potamos, Mavra, Hag, Cyprus, 1-1-37, *Kennedy* 1.

Tortula cunefolia (*Dicks.*) *Roth.*

Igneous rocks on the dry mountain side, c. 3000 feet, near Platres, Cyprus, 16-12-36, *Kennedy* 40.

Tortula marginata (*B. & S.*) *Spruce.*

Near stump of felled oak on exposed ridge, c. 1800 feet, Gkiotche Bounar, 5-11-33, *Tedd* K. 75.

Tortula muralis (*L.*) *Hedw.*

On stones and mortar on shady side of water fountain, c. 2000 feet, Otman Euren, 6-12-33, *Tedd* K. 59. In vertical crevices of schistose rocks, c. 600 feet, Xanthi–Shahin road, west Thrace, 4-1-34, *Tedd* K. 82. On rocks, near Panteleëmon, Athos Peninsula, South Macedonia, 13-4-34, *Hill*, *Sandwith* and *Turrill* 2808.

Syntrichia subulata (*L.*) *Web. et Mohr.*

Earthy bank at roots of scrub of *Carpinus orientalis*, c. 700 feet, near Isidja, Thrace, 7-1-34, *Tedd* K. 74. Rock crevices in valley facing north, c. 700 feet, Xanthi–Shahin road, Km. 7, Thrace, 3-35, *Tedd* K. 144. Igneous rock in a gully on the mountainside, c. 4400 feet. Platres, Cyprus, 10-12-36, *Kennedy* 36. Igneous rock above the river, c. 4400 feet, Potamos, Cyprus, 10-12-36, *Kennedy* 37. Igneous rock under pine trees in a gully above the stream, c. 4400 feet, Potamos, Cyprus, 23-12-36, *Kennedy* 50. On rock, c. 3500 feet, Platres, Cyprus, 7-1-37, *Kennedy* 7. On rock, c. 4100 feet, Kryos Potamos, Cyprus, 22-1-37, *Kennedy* 10. On rock, c. 4500 feet, Potamos, Cyprus, 22-1-37, *Kennedy* 11. On rock, c. 4900 feet, Kryos Potamos, Cyprus, 22-1-37, *Kennedy* 12.

Syntrichia montana *Nees.*

Among rocks, near Xanthi, Thrace, 12-30–2-31, *Tedd* K. 3. Limestone rock faces and crevices, c. 600 feet, Xanthi–Shahin road, Km. 6, Thrace, 17-4-35, *Tedd* K. 157. On bare igneous rock, c. 3150 feet, Phini, Cyprus, 13-12-36, *Kennedy* 39. On rock, c. 4600 feet, south west of Chionistra, Cyprus, 22-12-36, *Kennedy* 44. Igneous rock under pine on the mountain side, c. 4000 feet, Kryos Potamos, Cyprus, 23-12-36, *Kennedy* 49. On rock, c. 3000 feet, Platres, Cyprus, 3-1-47, *Kennedy* 6.

Syntrichia ruralis *Brid.*

On igneous rock, c. 4600 feet, south west of Chionistra, Cyprus, 22-12-36, *Kennedy* 47.

Syntrichia princeps (*De Not.*) *Mitt.*

Rock in the pine forest on the mountainside, c. 4100 feet, Platres, Cyprus, 9-12-36, *Kennedy* 33. On igneous rock under pine trees on the mountainside, c. 4450 feet, Platres, Cyprus, 9-12-36, *Kennedy* 34. On a limestone wall, c. 3100 feet, Omodos, Cyprus, 1-2-37, *Kennedy* 15. On a limestone wall, c. 3100 feet, Omodos, Cyprus, 1-2-37, *Kennedy* 16. Igneous rock under pine trees in a gully above the stream, c. 4100 feet, Kryos, Potamos, Cyprus, 4-2-37, *Kennedy* 24. Igneous rock by the river, c. 4400 feet, Xerokolymbos, Cyprus, 17-2-37, *Kennedy* 28.

***Pterygoneurum pusillum** (*Hedw.*) *Broth.*

On sandy exposed patch of soil among limestone rocks at the top of a ridge, near Xanthi, Thrace, 9-1-38, *Tedd* K. 234.

***Phascum acaulon** *L.*

Grassy and exposed earth banks at the top of a small ditch, c. 200 feet, near Mizanli, Thrace, 23-2-36, *Tedd* K. 173.

Pottia starkeana (*Hedw.*) *C. Mull.*

On the ground, near Inhauli, Thrace, 13-1-34, *Tedd* K. 95.

***Pottia truncatula** (*L.*) *Lindb.*

On sandy patches and among short grass bordering a copse, near Porto Lagos, 12-1-33, *Tedd* K. 61.

***Pottia intermedia** (*Turn.*) *Fürnr.*

Gravelly slopes of foothills, among bushes of *Quercus coccifera*, c. 500 feet, Kizildja Mursaal, Thrace, 11-1-34, *Tedd* K. 89. Gravel and stones at roadside, c. 1200 feet, near Elmali, Thrace, 25-3-34, *Tedd* K. 120. Near Ketcheli, Thrace, 24-2-35, *Tedd* s.n.

Pottia lanceolata (*Hedw.*) *C. Müll.*

On the ground, near Inhali, Thrace, 13-1-34, *Tedd* K. 96. On dry stone walling of road, c. 1200 feet, near Elmali, Thrace, 25-3-34, *Tedd* K. 119.

Pottia sp. (sterile).

Bank of earth among shrubs of *Carpinus orientalis*, c. 1500 feet, near Kouyounkerry, Thrace, 28-1-34, *Tedd* K. 113.

GRIMMIALES

Grimmia apocarpa (*L.*) *Hedw.*

On rocks, uncommon, c. 600 feet, Xanthi–Shahin road near Macaclar, Thrace, 14-1-33, *Tedd* K. 69. On rocks, Mount Lovcen, Montenegro, 15-3-35, *Turrill* s.n. On trees and rocks, c. 2000 feet, above Yassikerry, Thrace, 14-6-36, *Tedd* s.n.

Grimmia campestris *Burch.*

Tufts on rocks, c. 2000 feet, Otman Euren, Thrace, 16-12-33, *Tedd* K. 77.

Grimmia pulvinata (*L.*) *Smith.*

In tufts or cushions on rocks, common, c. 600 feet, near Atmadjali, Thrace, 27-10-33, *Tedd* K. 53.

Grimmia trichophylla *Grev.*

On rocks, in deep and shaded crevices formed by stream, c. 1200 feet, near Gkiotche Bounar, Thrace, 26-1-36, *Tedd* K. 165. Igneous rock under pine trees on the mountainside, c. 4000 feet, Platres, Cyprus, 9-12-36, *Kennedy* 32. Igneous rock, c. 3150 feet, Phini, Cyprus, 13-12-36, *Kennedy* 38. On rock, c. 3000 feet, Phini, Cyprus, 3-1-37, *Kennedy* 5.

***Rhacomitrium canescens** (*Timm.*) *Brid.*

In tufts among rocks of micaceous schist, c. 2000 feet, Gkiotche Bounar, Thrace, 5-11-33, *Tedd* K. 49.

***Rhacomitrium hypnoides** (*L.*) *Lindb.*

Damp places in small ravine shaded by beech, c. 2200 feet, Karpouz Tepé, Thrace, 11-10-36, *Tedd* K. 197.

FUNARIALES

Funaria hygrometrica (*L.*) *Sibth.*

Tufts among rocks, c. 600 feet, Xanthi–Shahin road, Thrace, 4-1-34, *Tedd* K. 83. Bare earth patches on old camp fire sites also on relicts of lime-kilns and charcoal kilns, c. 800 feet, near Emirli, west Thrace, 7-1-34, *Tedd* K. 84. Banks of earth, c. 400 feet, Xanthi–Shahin road, 7 km., Thrace, 7-11-36, *Tedd* K. 198. On rock, c. 3900 feet, Kryos Potamos, Cyprus, 22-1-37, *Kennedy* 8.

EUBRYALES

***Mniobryum carneum** (*L.*) *Limpr.*

On bank of earth and grass, near stream, c. 1800 feet, Xanthi–Shahin road, Thrace, 8-11-36, *Tedd* K. 201. On stones and mortar of an old fountain, c. 400 feet, Xanthi–Shahin road, Thrace, 20-11-37, *Tedd* K. 209.

***Mniobryum albicans** (*Whbg.*) *Limpr.*

Stones and bank of stream in a small wood, c. 500 feet, Derecol valley, Thrace, 7-3-37, *Tedd* K. 214. On bank of earth near a spring, c. 600 feet, below Atmadjali, Thrace, 14-3-37, *Tedd* K. 212.

****Bryum duvalii** *Voit.*

Above Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2801.

Bryum intermedium (*Ludw.*) *Brid.*

Among limestone rocks of rough path, previously fired (possibly a kiln), Vathy, Thasos Island, 19-4-34, *Tedd* K. 122.

Bryum alpinum *Huds.*

Near rocks at sheepfold, c. 4000 feet, Kartal Dagh, Thrace, 2-7-36, *Tedd* K. 186.

Bryum capillare *L.*

On non-calcareous rocks, c. 500 feet, Xanthi–Shahin road, Thrace, 17-12-33, *Tedd* K. 73. Above Panteleëmon, Athos Peninsula, south Macedonia, 14-4-34, *Hill*, *Sandwith* and *Turrill* 2793. Near Pyrgos, Athos Peninsula, south Macedonia, 16-4-34, *Hill*, *Sandwith*, and *Turrill* 2816. Tufts among rocks and earth, c. 600 feet, near Xanthi, Thrace, 24-10-36, *Tedd* K. 195. In macchie, near Heraklitza, Thrace, 23-4-37, *Tedd* K. 216. In a community of *Erica verticillata*, near Doghandjilar, Thrace, 25-4-37, *Tedd* K. 217. Rocks under bushes amongst macchie on the north west side of the islet, c. 100 feet, Kizil Ada near Cavalla, Thrace, 12-9-37, *Tedd* s.n.

Bryum obconicum *Hornsch.*

Rock crevices facing north, c. 800 feet, hills near Xanthi, Thrace, 15-11-33, *Tedd* K. 55. Igneous rocks by the river, c. 4900 feet, Xerokolymbos, Cyprus, 13-4-37, *Kennedy* 30.

Bryum argenteum *L.*

Stones on old road, c. 200 feet, Moussafacli, west Thrace, 31-1-35, *Tedd* K. 141.

***Rhodobryum roseum** *Limpr.*

Damp doline, near Brisciki, Karst, 25-4-35, *Turrill* s.n.

****Mnium punctatum** *Hedw.*

On earth and rock on bank of a small spring, open ground near summit of ridge, c. 5000 feet, Tchingané Issar, Thrace, 18-7-33, *Tedd* K. 45.

***Mnium stellare** *Reich.*

On slopes of Athos peak, high above Lavra, Athos Peninsula, South Macedonia, 20-4-34, *Hill*, *Sandwith* and *Turrill* 2819.

Mnium undulatum *Weis.* det. C.V.B. Marquand.

Wet overhang of small stream in wooded valley, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 17. On wet rocks, Demirdjik, Thrace, 27-6-34, *Tedd* s.n. Vatopedi, Athos Peninsula, South Macedonia, 18-12-45, *Vine* s.n.

Mnium cuspidatum *Leyss.*

Humus and stones of a shaded valley near a waterfall, c. 1800 feet, near Kozlondja, Thrace, 7-4-34, *Tedd* K. 107. Earthy bank in a wood facing north-west, c. 800 feet, near Ketcheli, west Thrace, 21-4-35, *Tedd* K. 146.

***Mnium medium** *B. & S.*

In grass among bushes of *Carpinus orientalis*, north side of hill slope, c. 600 feet, Xanthi–Shahin road, Thrace, 21-1-34, *Tedd* K. 92.

***Mnium hornum** *L.*

Sandy damp place in shade of large rock by side of stream, c. 1800 feet, near Kozlondja, Thrace, 7-4-34, *Tedd* K. 108.

***Bartramia oederi** *Sw.*

Among calcareous rocks and stones ; c. 3200 feet ; Tchal Dagh, near Xanthi, Thrace ; 10-6-34, *Tedd* K. 125. In shade of small bushes of beech, small ravine, on the ground ; c. 2200 feet ; Karpouz Tepé near Xanthi, Thrace, 11-10-36, *Tedd* K. 188.

Bartramia ithyphylla (*Hall.*) *Brid.*

Shady place among rocks bordering pool, c. 1500 feet, near Kozlondja, Thrace, 7-4-34, *Tedd* K. 121.

***Bartramia pomiformis** *Hedw.*

Near Pyrgos, South Macedonia, Athos Peninsula, 16-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Above Chilandari, Athos Peninsula, South Macedonia, 23-4-34, *Hill*, *Sandwith* and *Turrill* s.n.

Bartramia stricta *Brid.*

Tufts on non-calcareous rocks, c. 600 feet, Xanthi–Shahin road, Thrace, 4-1-34, *Tedd* K. 81. Among rocks near sea level, near Cavalla, Macedonia, 6-5-34, *Tedd* K. 124. Rock crevices on west side of rocky valley, c. 400 feet, near Kouyounkerry, west Thrace, 27-3-35, *Tedd* K. 143. Rock crevices (not limestone), c. 600 feet, Xanthi–Shahin road, west Thrace, 3-35, *Tedd* K. 152.

Philonotis calcarea *Schimp.*

On tree stumps in running water, near Xanthi, Thrace, 4-2-31, *Tedd* K. 6.

Philonotis fontana (*L.*) *Brid.*

Wet places in marshy ground near rising springs, c. 5000 feet, Lailia near Serres, South Macedonia, 16-6-35, *Tedd* K. 149.

Timmia bavarica *Hessl.*

Rocks, rock crevices and tree stumps, Atmadjali, Thrace, 22-3-31, *Tedd* K. 16. Stones, c. 3000 feet, Tchal, west Thrace, 10-6-34, *Tedd* s.n.

ISOBRYALES

Orthotrichum anomalum *Hedw.* var. **saxatile** (*Brid.*) *Milde.*

On rocks, Mount Lovcen, Montenegro, 15-4-35, *Turrill* s.n. On rocks, near Brisciki, Karst, 25-4-35, *Turrill* s.n.

Orthotrichum rupestre *Schleich.*

On non-calcareous rocks at top of ridge, c. 1500 feet, Kouyounkerry, west Thrace, 28-1-34, *Tedd* K. 117.

Orthotrichum affine *Schrad.*

On branches of shrubs of *Carpinus orientalis*, c. 600 feet, near Atmadjali, Thrace, 27-10-33, *Tedd* K. 52. Bole of walnut tree, hills east of Shahin road, c. 1000 feet, near Xanthi, west Thrace, 7-11-35, *Tedd* s.n.

***Orthotrichum stramineum** *Hornsch.*

On bark of beech tree, mostly on north side, c. 3000 feet, near Karpouz Tepé, Thrace, 8-12-35, *Tedd* K. 160.

Hedwigia albicans (*Web.*) *Lindb.*

On rocks ; c. 600 feet ; near Macaclar, Xanthi–Shahin road, Thrace, 10-33, *Tedd* K. 68.

Leucodon sciuroides (*L.*) *Schwaegr.* var. **morensis** *de Not.*

Igneous rock in the pine forest, c. 4400 feet, Kephaloorigson, Platres, Thrace, 2-2-37, *Kennedy* 20. Near Duzi, west of Trebinje, Hercegovina ; 18-4-35, *Turrill* s.n. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n.

Pterogonium ornithopodioides (*Huds.*) *Lindb.*

Non-calcareous rocks near Macaclar, c. 600 feet, Xanthi–Shahin road, Thrace, 14-12-33, *Tedd* K. 70. Near Pyrgos, south Macedonia, Athos Peninsula, 16-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Near Dionysiou, Athos Peninsula, south Macedonia, 18-4-34, *Hill*, *Sandwith* and *Turrill* s.n.

Leptodon smithii (*Dicks.*) *Mohr.*

Near Dionysiou, south Macedonia, Athos Peninsula, 18-4-34, *Hill*, *Sandwith* and *Turrill* s.n. On a small tree of *Cornus mas* among shrubby *Fagus orientalis*, c. 1500 feet, Xanthi–Shahin road, Thrace, 8-11-36, *Tedd* K. 200. Igneous rock overhanging the river, c. 4000 feet, Kryos Potamos, Cyprus, 23-12-36, *Kennedy* 48. Igneous rock under plane trees on flat ground beside the river, c. 4300 feet, Xerokolymbos, Cyprus, 6-2-37, *Kennedy* 27.

Neckera crispa (*L.*) *Hedw.*

Stumps of trees and shrubs, c. 400–500 feet, Xanthi–Shahin road, Thrace, 14-12-33, *Tedd* K. 71. On rocks, near Kozlondja, Thrace, 11-11-34, *Tedd* s.n. On rocks, Mount Lovcen, Montenegro, 15-4-35, *Turrill* s.n. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. Near Brisciki, Karst, 25-4-35, *Turrill* s.n.

Neckera complanata (*L.*) *Hüb.*

Wood and humus, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 24. det. C. V. B. Marquand. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. Near Brisciki, Karst, 25-4-35, *Turrill* s.n.

Thamnium alopecurum (*Hedw.*) *B. & S.*

Humus, decaying wood and debris in wooded valley, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 21.

Isothecium viviparum (*Neck.*) *Lindb.*

Dry rocks in shaded valley, c. 1800 feet, near Kozlondja, Thrace, 7-4-34, *Tedd* K. 110. About half way up the eastern slopes of Athos Peak, Athos Peninsula, South Macedonia, 21-4-34, *Hill*, *Sandwith* and *Turrill* 2771.

Fontinalis antipyretica *L.*

Attached to rocks in clear running water, semi-submerged, c. 1500 feet, near Kozlondja, Thrace, 23-7-33, *Tedd* K. 47. Above Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2799. In a small subsidiary stream flowing from calcareous rock, c. 100 feet, Nestos River near Oktchilar, Thrace, 21-11-37, *Tedd* K. 206.

HYPNOBRYALES

Anomodon viticulosus (*L.*) *Hook. et Tayl.*

Wood debris and stone slopes, c. 300 feet, Atmadjali, Thrace. 10-1-32, *Tedd* K. 26. det. C. V. B. Marquand. Stones and rocks, Kozlondja, Thrace, 7-4-34, *Tedd* s.n. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. Shady places among steep limestone rocks, c. 400 feet, Xanthi–Shahin road, Thrace, 12-11-37, *Tedd* s.n.

Anomodon attenuatus (*Schreb.*) *Hüben.*

Among stones etc. at base of tree stumps, wooded hill-slopes, c. 600 feet, Xanthi–Shahin road, Thrace, 10-12-35, *Tedd* K. 168. On rocks and among roots of hazel bushes bordering small stream, damp and shady place, c. 800 feet, near Ketcheli, Thrace, 29-1-36, *Tedd* K. 167.

***Leskea polycarpa** *Hedw.*

On bole of ash tree about 6 feet from ground, near Porto Lagos Lidja, 12-12-33, *Tedd* K. 60.

***Thuidium tamariscifolium** *Lindb.*

Around roots, etc., of bushes on semi-wooded hillside, c. 500 feet, Xanthi–Shahin road, Thrace, 17-10-36, *Tedd* s.n.

***Thuidium recognitum** (*Hedw.*) *Lindb.*

Rocks and tree stumps, c. 800 feet, near Ketcheli, west Thrace, 24-2-35, *Tedd* K. 142.

Cratoneurum commutatum *Moenkem.*

In masses in a stream drip on non-calcareous rocks, among shrubs of *Fagus orientalis*, c. 1800 feet, Xanthi–Shahin road, Thrace, 8-11-36, *Tedd* K. 203.

Cratoneurum filicinum (*Hedw.*) *Roth.*

At side of wooden trough of spring, c. 2200 feet. Mount Pangaion, Macedonia, 5-10-33, *Tedd* K. 48. Damp rocks in shaded woody valley, c. 1800 feet, near Kozlondja, Thrace, 7-4-34, *Tedd* K. 109. Stones surrounding spring, c. 800 feet, near Ketcheli, west Thrace, 24-2-35, *Tedd* 153 A. Dense masses in dripping stream bed, c. 1800 feet, Xanthi–Shahin road, Thrace, 8-11-36, *Tedd* s.n.

Chrysohypnum chrysophyllum (*Brid.*) *Loeske.*

Among *Quercus coccifera* scrub, c. 500 feet, Kizildja Mursaal, Thrace, 11-1-34, *Tedd* K. 90. Earth in oak woods, c. 2000 feet, near Demirdjik, Thrace, 7-4-34, *Tedd* K. 112.

Amblystegium serpens (*Hedw.*) *B. & S.*

Bole of elm tree, near ground level, near Inhanli, Thrace, 13-1-34, *Tedd* K. 93. Walls of a well shaded by trees in a hollow, c. 700 feet, near Oktchilar, Thrace, 14-11-37, *Tedd* K. 219.

***Amblystegium riparium** *Hedw.*

On stone forming basin of spring under water, c. 500 feet, near Courlar, Thrace, 9-4-33, *Tedd* K. 44.

Camptothecium sericeum (*L.*) *Kindb.*

On tree stumps, near Xanthi, Thrace, 12-30–2-21, *Tedd* K. 7. On non-calcareous rocks, c. 600 feet, Xanthi–Shahin road, Thrace, 4-1-34, *Tedd* K. 97. Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Near Pyrgos, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2815. Tree stumps and bank, c. 800 feet, Atmadjali, Thrace, 3-3-35, *Tedd* K. 147. Near Trebinje, Hercegovina, 18-4-35, *Turrill* s.n. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. Igneous rock under pine tree in a gully, c. 4450 feet, Platres, Cyprus, 9-12-36, *Kennedy* s.n. On a branch broken from an old tree, c. 3200 feet, Omodos, Cyprus, 1-2-37, *Kennedy* 13. On a limestone wall, c. 3100 feet, Omodos, Cyprus, 1-2-37, *Kennedy* 15. Igneous rock under pine trees in a gully running down to the river, c. 4100 feet, Kryos Potamos, Cyprus, 4-2-37, *Kennedy* 22. Near Platres, Cyprus, (received) 20-2-39, *Kennedy* s.n.

Camptothecium lutescens (*Hedw.*) *Brid.*

Damp bank, shady side of fence, c. 1800 feet, Gkiotche Bounar, Thrace, 5-1-33, *Tedd* K. 50. On rocks, Mt. Lovcen, Montenegro, 15-4-35, *Turrill* s.n. Near Brisciki, Karst, 25-4-35, *Turrill* s.n. On limestone rocks of railway cutting etc., c. 100 feet, Nestos valley, Thrace, 21-11-37, *Tedd* K. 211.

Brachythecium salebrosum (*Web. & Mohr*) *B. & S.*

Above Panteleëmon, Athos Peninsula, South Macedonia, 14-3-34, *Hill*, *Sandwith* and *Turrill* 2786.

***Brachythecium rutabulum** (*Hedw.*) *B. & S.*

On boles of trees near base in shady places of small copse, Bekkery, *Tedd* 20-9-33, K. 58. Near Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2809.

***Brachythecium rivulare** (*Bruch*) *B. & S.*

Marshy ground, c. 200 feet, Emirli, Thrace, 8-5-32, *Tedd* 830.

Bachythecium velutinum (*Hedw.*) *B. & S.*

On earth and stones in oak woods, c. 1800 feet, near Kozlondja, Thrace 7-4-34, *Tedd* K. 111. In crevices of schistose rocks and closely adpressed, c. 700 feet, near Ketcheli, Thrace, 29-1-36, *Tedd* K. 170. Igneous rock under pine trees, c. 4300 feet, Kephalodryson, Platres, Cyprus, 2-2-37, *Kennedy* 53. Bank of a bridle path up the mountainside, c. 2800 feet, Aphamis, Cyprus, 3-2-37, *Kennedy* 18.

Brachythecium populeum (*Hedw.*) *B. & S.*

On a branch broken from an old tree, c. 3200 feet, Omodos, Cyprus, 1-2-37, *Kennedy* 13. Stone wall, c. 3100 feet, Omodos, Cyprus, 1-2-37 *Kennedy* 17. Under a hedge on limestone rocks, semi-humus, c. 600 feet, below Atmadjali, Thrace, 14-11-37, *Tedd* K. 208.

Scleropodium illecebrum (*Hedw.*) *B. & S.*

In tufts and cushions in humus at roots of trees, etc., c. 2000 feet, near Demirdjik, 3-33, *Tedd* K. 43A. Near Pyrgos, Athos Peninsula, South Macedonia, 17-4-34, *Hill*, *Sandwith* and *Turrill*. Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith* and *Turrill* 2792 and 2795. Near Stravronikita, Athos Peninsula, South Macedonia, 21-4-34, *Hill*, *Sandwith* and *Turrill* 2821. Earthy bank among rocks etc., and at roots of hazel shrubs, c. 800 feet, near Ketcheli, Thrace. 29-1-36, *Tedd* K. 169.

***Scleropodium purum** (*L.*) *Limpr.*

Above Chilandari, Athos Peninsula, South Macedonia, 23-4-34, *Hill*, *Sandwith* and *Turrill* 2806.

Eurhynchium circinatum (*Brid.*) *B. & S.*

Limestone rock crevices and among roots of *Carpinus orientalis*, c. 600 feet, Xanthi–Shahin road, Thrace, 17-4-34, *Tedd* K. 154.

Eurhynchium swartzii *Hobk.*

Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith*, and *Turrill* 2783. Above Zographu, South Macedonia, Athos Peninsula, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2804. Earth bank of small gully in spray of small stream, c. 1500 feet, near Dolap Haw, Thrace, 19-1-36, *Tedd* K. 164.

Eurhynchium striatum (*Hedw.*) *Schpr.*

Decaying wood c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 22. det. C. V. B. Marquand.

Eurhynchium rusciforme (*Neck.*) *Milde.*

Attached to rocks in running water by small stream, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd*, K. 23. det. C. V. B. Marquand. Damp shady places, c. 2500 feet, near Demirdjik, Thrace, 33-3, *Tedd* K. 40.

Eurhynchium stokesii *B. & S.*

Near Stravronikita, Athos Peninsula, South Macedonia, 21-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Hills behind Pyrgos, Athos Peninsula, South Macedonia, 25-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Damp earth, edges of *Carpinus orientalis* shrubs, c. 700 feet, Xanthi–Shahin road, Thrace, 7-10-36, *Tedd* K. 194.

***Eurhynchium strigosum** *B. & S.*, var. **diversifolium** *Lindb.*

On tree roots and boles of *Carpinus* shrub, c. 1500 feet, near Kouyounkerry, Thrace, 28-1-34, *Tedd* K. 115. On stones and earth at roots of bushes of *Carpinus orientalis* and on loose schistose soil, c. 800 feet, near Xanthi, Thrace, 9-9-38, *Tedd* K. 233.

Rhynchostegium murale *B. & S.*

On stones by stream side, c. 800 feet, near Emirli, Thrace, 7-1-34, *Tedd* K. 87A.

Rhynchostegium confertum *B. & S.*

Wooded valley, stony slopes, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 19. On stones among shrubs, c. 1500 feet, near Kouyounkerry, Thrace, 28-1-34, *Tedd* K. 114. At foot of a willow tree in low lying grassland and open woods of willow and alder, c. 100 feet, near Doumenli, Thrace, 22-12-37, *Tedd* s.n.

Rhynchostegiella algiriana *Broth.*

Wall inside of disused lime klin, c. 400 feet, Xanthi–Shahin road, Thrace, 8-12-33, *Tedd* K. 64. Inside wall of disused lime kiln, c. 500 feet, Xanthi–Shahin road, Thrace, 17-4-35, *Tedd* K. 151.

Pterygynandrum filiforme *Hedw.*

Limestone precipice, c. 1000 feet, Kyrenia, Cyprus, 30-10-36, *Kennedy* 31A.

****Hypnum fertile** *Sendtn.*

In wooded valley on humus and decaying wood, c. 300 feet, Atmadjali, Thrace, 10-1-32, *Tedd* K. 18. det. C. V. B. Marquand.

Hypnum cupressiforme *L.*

On tree stumps, near Xanthi, Thrace, 12-30–2-31, *Tedd* K. 5. On rocks, c. 600 feet near Atmadjali, Thrace, 27-10-33, *Tedd* K. 54. Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith*, and *Turrill* 2785. Near Dionysiou, Athos Peninsula, South Macedonia, 18-4-34, *Hill*, *Sandwith* and *Turrill* 2780 and 2811. Near Duzi, west of Trebinje, Hercegovina 18-4-35, *Turrill* s.n. Igneous rock under pine trees on the mountainside, c. 4000 feet, Platres, Cyprus, 9-12-36, *Kennedy* 56. In macchie, near Heraclista, Thrace, 25-4-37, *Tedd* K. 217. Among bushes and at roots of shrubs, etc., in community of *Erica verticillata*, c. 400 feet, below Kayalar, Thrace, 10-12-37, *Tedd* K. 225.

***Hypnum cupressiforme** *L.* var. **filiforme** *Brid.*

Bole of oak tree, near base, c. 800 feet, near Dolap Haw, Thrace, 19-1-36, *Tedd* K. 163.

***Hypnum cupressiforme** *L.* var. **subjulaceum** *Mol.*

Crevices in schistose rocks, c. 800 feet, near Emirli, west Thrace, 3-3-35, *Tedd* K. 138.

Ctenidium molluscum (*Hedw.*) *Mitt.*

Among rocks, near Xanthi, Thrace, 12-30–2-31, *Tedd* K. 1 and K. 2. On rocks, Mount Lovcen, Montenegro, 15-4-35, *Turrill* s.n. Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. On stones and rocks in oak-beech wood facing north, c. 1500 feet, near Dolap Haw, Thrace, 19-1-36, *Tedd* K. 162.

***Rhytidium rugosum** (*Hedw.*) *Kindb.*

In tufts, in crevices of calcareous rocks facing north, c. 3600 feet, Karpouz Tepé, near Xanthi, Thrace, 11-10-36, *Tedd* K. 191.

Rhytidiadelphus triquetrus (*Hedw.*) *Warnst.*

Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n.

Hylocomium proliferum (*L.*) *Lindb.*

Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n. At base of small bushes of beech and on grassy slopes of hillside facing N. to N.W., c 1800 feet, near Gkiotche Bounar, Thrace, 26-1-36, *Tedd* K. 166.

BUXBAUMIINALES

Buxbaumiales

***Diphyscium sessile** (*Schmid.*) *Lindb.*

Amongst humus on floor of oak woods near tree roots, c. 2500 feet, Demirdjik, Thrace, 3-33, *Tedd* K. 41.

POLYTRICHINALES

Polytrichales

***Catharinaea undulata** (*L.*) *Web. et Mohr.*

Damp bank, shady side of fence, c. 1800 feet, Gkiotche Bounar, Thrace, 5-1-33, *Tedd* K. 51. Grass among bushes of *Carpinus orientalis*, north side of hill slope, c. 600 feet, Xanthi–Shahin road, Thrace, 21-1-34, *Tedd* K. 92. Among bushes of *Carpinus orientalis*, c. 600 feet, near Ketcheli, Thrace, 23-4-34, *Tedd* K. 123. Wet rocks, Demirdjik, Thrace, 27-6-34, *Tedd* s.n.

***Pogonatum nanum** (*Hedw.*) *P. d. B.*

Rock crevices facing north, ridge of schistose rock, c. 800 feet, hills near Xanthi, Thrace, 15-11-33, *Tedd* K. 56.

Pogonatum aloides (*Hedw.*) *P. d. B.*

Humus etc., on ground floor of oak woods, c. 2500 feet, near Demirdjik, Thrace, 3-10-33, *Tedd* K. 39.

***Polytrichum attenuatum** *Menz.*

Near Demirdjik, west Thrace, 5-9-35, *Tedd* K. 159. Edge of path in beech wood, c. 4000 feet, Mount Pangaion, Thrace, 29-8-37, *Tedd* K. 220.

***Polytrichum gracile** *Menz.*

Rocks of stream-bed (under water), c. 2000 feet, near Demirdjik, Thrace, 3-10-33, *Tedd* K. 42.

Polytrichum piliferum *Schreb.* Otman Euren, c. 1500 feet, Thrace, 6-12-33, *Tedd* K. 76.

***Polytrichum juniperinum** *Willd.*

On tree stumps, near Xanthi, Thrace, 12-30–2-31, *Tedd* K. 8. Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith* and *Turrill* 2796. Between Pyrgos and Xerxes Canal, Athos Peninsula, South Macedonia, 17-4-34, *Hill*, *Sandwith* and *Turrill* 2828.

Hepatics

[Nomenclature and systematic arrangement follows that of K. Müller].

Reboulia hemisphaerica (*L.*) *Raddi.*

Above Panteleëmon, Athos Peninsula, South Macedonia, 14-4-34, *Hill*, *Sandwith* and *Turrill* 2797. Walls near Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* s.n. Slopes of Athos peak, eastern side above Lavra, c. 2700 feet, Athos Peninsula, South Macedonia, 20-4-34, *Hill*, *Sandwith*, and *Turrill* s.n. Damp soil at base of rocks. Mount Lovcen, Montenegro, 15-4-35, *Turrill* s.n.

Lunularia cruciata (*L.*) *Dum.*

Igneous rocks by the river, c. 4000 feet, Potamos, Kryos, Cyprus, 21-1-37, *Kennedy* 51.

Marchantia polymorpha *L.*

At side of wooden trough of spring, c. 2200 feet, Mount Pangaion, Macedonia, 5-10-33, *Tedd* K. 48.

Pellia epiphylla (*L.*) *Lindb.*

Above Zographu, Athos Peninsula, South Macedonia ; 16-4-34, *Hill*, *Sandwith* and *Turrill* 2803.

Pellia fabbroniana *Raddi.*

Earth bank and water of small hollow " drip ", c. 1800 feet, Xanthi–Shahin road, Thrace, 8-11-36, *Tedd* K. 205.

Fegatella conica *Corda.*

Above Zographu, Athos Peninsula, South Macedonia, 16-4-34, *Hill*, *Sandwith* and *Turrill* 2798.

Metzgeria furcata (*L.*) *Lindb.*

Igneous rock at the river's edge, c. 4000 feet, Kryos Potamos, Platres, Cyprus, 23-12-36, *Kennedy* s.n.

Fossombronia husnoti *Corb.*

In ground between tufts of *Erica verticillata*, c. 400 feet below, Kayalar, Thrace, 10-12-37, *Tedd* K. 227.

Radula complanata (*L.*) *Dum.*

In branches of shrubs of *Carpinus orientalis*, c. 600 feet, near Atmadjali, Thrace, 27-10-33, *Tedd* K. 52A.

Madotheca platyphylla (*L.*) *Dum.*

Monte Re, Nanos, Karst, 24-4-35, *Turrill* s.n.

Frullania tamarisci (*L.*) *Dum.*

Wet mossy banks, rocks, trunks of trees etc., c. 400 feet, Xanthi–Shahin road, Thrace, 9-12-33, *Tedd* K. 66. Near Dionysiou, Athos Peninsula, South Macedonia, 18-4-34, *Hill*, *Sandwith* and *Turrill*. Damp earth on decayed wood and rocks, c. 500 feet, Xanthi-Shahin road, Thrace, 17-11-36, *Tedd* K. 193.

The writer wishes to thank Dr. W. B. Turrill for his assistance.

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PROFESSOR NAONORI HIROTA'S WORK ON CAMPHOR TREES.

BARBARA J. YOUNGMAN.

Prof. Naonori Hirota, of the Ehime University, Japan, was formerly employed by the Government Monopoly Bureau of Formosa, which controlled the production and export of camphor on the island. While there he did much interesting work on camphor trees and camphor production. The details of this are as yet unpublished, but are to appear in Memoirs of Ehime University Sect. 2, **1,** No. 2, 1951. The following account may serve to give some idea of the scope of the work and its potential importance from the economic or practical point of view.

Within a decade of 1880 the celluloid industry had been started in England and in the United States. During the early years of this century it developed rapidly, requiring increased amounts of camphor. In this way camphor, once a precious medicine of the Orient became a material essential to the industries of the West. Many European countries and the U.S.A. made attempts to obtain sufficient camphor for their needs and since, in the accessible regions of China, it had been exhausted, attention was concentrated on Formosa. The Japanese government, however, monopolised the production and trade in camphor from the island. As a result of these difficulties numerous European countries and the U.S.A. started planting camphor in their own countries or their colonies, depending on the climate, and attempts were made to obtain camphor from leaves and branches a few years after sowing. Seeds in most instances were obtained from Japan, China and Formosa, although there may have been some camphor trees in France, Italy and other countries. It was found that while some trees produced free crystalline camphor, from others no solid camphor was forthcoming and camphor oil only obtained on distillation. In this way discussions about the forms of the camphor tree and the reasons for the differences in camphor content were initiated in various parts of the world.

The usual botanical system of classification of camphor trees is as follows :—

(a) *Cinnamomum camphora* Sieb.

(b) *Cinnamomum camphora* Sieb. var. *nominale* Hayata.
(*Cinnamomum nominale* Hayata.).

This system is based on morphological characters and bears no relation to the properties or the constituents of the essential oils present.

Camphor trees have also been divided into four other groups by the Govt. Monopoly Bureau from the view point of crude camphor production.

(a) " Ho-Sho " essential oil in the wood contains linalool.
1. " Ho-Sho " contains no free crystalline camphor.
2. "In-Yo-Sho" contains free crystalline camphor.

(b) " Hon-Sho " no linalool present in oil.
1. " Yu-Sho " only liquid essential oil.
2. " Shin-Sho " contains free crystalline camphor as well as liquid essential oil.

This classification is convenient for industrial purposes but has no scientific basis. As a result of his studies of the camphor tree Hirota has put forward another scheme of classification. The camphor trees of Japan and Formosa differ from one another in several morphological respects and are therefore classified in separate groups.

These are termed " sub-species " and differ in the following characters :—

1. Size of flowers.
2. Shape and size of seeds.
3. Thickness of leaves.
4. Time of flowering.

The Japanese trees all contain free crystalline camphor in the leaves and are therefore all termed " eucamphor " trees. Investigations in different areas of Formosa, however, showed that trees in the east coast mountains of the island differ from trees growing in northern and western Formosa in the following points.

1. Smaller flowers.
2. Wavy edge of leaf.
3. Flowering three times annually instead of once as in the " West ".
4. Smaller fruits and seeds.
5. Larger number of leaves (compared on 1 year old trees).
6. Lighter leaves.
7. Fruit borne after 3 years (" West " and Japanese trees are said not to bear fruit for 15–30 years).
8. Vigorous power of sending out shoots.

The " East " camphor tree is a large evergreen forest tree, as tall as the " West " camphor tree but more vigorously sprouting. It can grow in " sunny deserts ", in which situation it may be described as shrubby, being not usually more than 3 m. tall and 1–5 cm. in diameter. In other areas the larger trees may reach 40 m. in height and 2–2·4 m. in diameter. They mostly flower three years after sowing although it was noticed that some seedlings bore fruit in one year. They tend to shoot out many more branches than the " West " tree, and their branches grow bending down towards the ground. Leaves are slender and thin with wavy edges. The back of the leaf is covered with a wax like powder but less noticeably than in the " West " tree. Flower stalks are pale yellow and the corolla and seeds are smaller. Trees which bloom from July to August do not bear fruit ; a few having flowers between October and November bear fruit, while those flowering from January to March have fruits which ripen, turning black in July or August.

It is considered that the " Rau-Kusu " the *Cinnamomum camphora* var. *nominale* Hayata (later named *Cinnamomum nominale* Hayata) is a form of this " East " camphor tree. Hayata was probably misled originally by the sample he examined, it being from unfavourable districts where the trunks are often damaged or destroyed by rough weather causing the trees to shoot repeatedly from the base and thus appear bushy.

The " East " camphor tree can be divided into several sub-varieties (at present seven) according to the constituents of the essential oils in the leaf. There is apparently no botanical difference between these sub-varieties but they are quickly distinguished by the odour of the leaf. The " West " camphor tree can also be divided into several sub-varieties corresponding with those of the " East ".

The leaf oils were chosen as a basis for this classification because they are of constant composition, although oil from other parts of the plant may vary from year to year. In order to obtain the essential oil for determining the physical constants, etc., leaves together with very small branches were collected and distilled with steam. It was found that the leaves alone were inconvenient to treat and it was difficult to distil the essential oil smoothly owing to the pulpy mass which they formed. The small branches included contained only a very small quantity of essential oil so that it could be ignored, and the oil obtained regarded as coming from the leaves alone. The apparatus used was a " concise distillator " made for the purpose (see Rept. Ass. Camphor Ind. Eng. Japan, **3,** 189) and holding 2–4 kg. leaves. The condenser and receiver were designed so as to make possible the collection of either solid camphor or liquid essential oil. In spite of the age of the trees, the sampling season, place of growth etc., it was found that the essential oil from the leaves had physical constants and proportion of constituents within so narrow a range that the trees could be subdivided on the basis of their essential oils. Density, refractive index and optical rotation in particular vary within such a narrow range that they are a sub-varietal characteristic. By sowing seeds of each sub-variety and examining the leaf oil from seedlings it was further shown that these sub-varieties exist and are constant. When the seedling first sprouts the essential oil of the leaves is chiefly safrol, however, when the seedling has from 16–17 leaves it contains the essential oil characteristic of that sub-variety. It may here be noted that all sub-varieties contain safrol as the chief component of the essential oils from their fruits so it is thought to play a special physiological role in camphor trees.

The "East" camphor trees are subdivided in the following way :—

East eucamphor tree	main constituent of oil	camphor.
,, cineol ,,	,, ,, ,, ,,	cineol.
,, safrol ,,	,, ,, ,, ,,	safrol.
,, sesquiterpene tree ,,	,, ,, ,,	sesquiterpene and sesquiterpene alcohol.
,, linalool ,,	,, ,, ,, ,,	linalool.
,, linaloid ,,	,, ,, ,, ,,	linalool.
,, borneol ,,	,, ,, ,, ,,	borneol.

Probably the " sesquiterpene " trees could in fact be classed as two separate sub-varieties. There are six kinds of the " West " camphor tree ; the one corresponding to the " East borneol " tree has not been found. Borneol was found only among the " East " camphor trees which had free crystalline borneol in the trunk oil, but the physical constants of the leaf oil were of the " cineol " tree. In the " West " camphor trees the ranges of physical constants are similar to those of the

" East " but the range of deviation is narrower in the former. It may be said that the " West " sub-varieties are more fixed. Generally the yield of leaf oil is somewhat larger than that of the " East " camphor tree.

The distribution of the sub-varieties of the " East and West " trees differs. With the " West " camphor tree few of the so called "eucamphor' and " linalool " trees exist in southern Formosa, while the " sesquiturpene' tree, the " safrol " tree and the " cineol " tree increase in number towards the southern region. A few " linaloid " trees exist throughout north and south. It is supposed that this is due to the fact that the " East " camphor trees bear fruit earlier so cross fertilization occurs more freely. Figures illustrating the distribution of the sub-varieties are of interest. Five reserve forests of " East " camphor trees were chosen and from a standard part of an area of 9 acres in each forest the numbers of each sub-variety growing there were ascertained and the " distribution percentages " calculated.

East eucamphor trees	...	...	288
East cineol trees	...	...	12
East sesquiterpene trees		...	9
East safrol trees	...	...	57
East linalool trees	...	...	456
	Total	...	822

Seeds of each sub-variety were sown. The numbers of trees of the different sub-varieties obtained were counted and the " heredity percentages " (that is the percentage of the progeny that are the same sub-variety as the parent tree) obtained. These were near to the " distribution percentages " calculated from the figures above.

Many camphor trees standing in the Formosan mountains, where the actual camphor production was in progress, were investigated in order to obtain a comparison between the classification of the Government Monopoly Bureau and that into " sub-varieties " as given above. The following were the results obtained :—

" Ho-Sho "	all the " linalool " trees.
" In-Yo-Sho "	all the " linaloid " trees.
" Yu-Sho "	all the " cineol " trees, half the " sesquiterpene " trees and a few " safrol " trees.
" Shin-Sho "	all the " eucamphor " trees, a large number of " safrol " trees and half of the " sesquiterpene " trees.

So much for the camphor trees of Formosa, we now turn to those of other countries. It has already been pointed out that the camphor trees growing in Japan all contain free crystalline camphor. In 1940 camphor trees in various districts of China were investigated and it is suggested that these are the same botanically as the " West " camphor tree, of Formosa. The distribution of the sub-varieties is, however, different but it is thought this may be due to the fact that the "eucamphor" and the " linalool " trees have already been almost exhausted. Two New Zealand camphor trees transplanted to Japan and investigated appear to be akin to the Japanese trees but seeds from the trees, when

sown produced " eucamphor " and " cineol " trees. Physical constants of essential oils from leaves of trees grown in various other countries have been investigated and there seem to be no report of " safrol ", " linalool " or " sesquiterpene " trees among them. This is surprising since it is supposed that those sub-varieties must have been derived from the seeds transported from China and Formosa.

Although leaf oil has been the basis of this classification of camphor trees, large differences exist between the leaf oil and that obtained from the wood—the normal camphor oil obtained in camphor production. In any but the " eucamphor " tree the content of camphor is small and each principal component contained so largely that the leaf oil can be called a " special essential oil ". In fact some trees yield leaf oils in which camphor cannot be detected by any known method.

" Linalool " is used as a base for various aromatics. That obtained from normal camphor tree oil is considered inferior because it has an odour of camphor and is also exceedingly difficult to isolate. On the other hand " linalool " can be obtained very readily by fractional distillation from the essential oil of leaves and is suitable for use in aromatic preparations. " Safrol " and " cineol " can also be easily isolated from leaf oils, the former being employed in the production of vanillin, etc. " Linalool " is synthesized in the leaves only of the " linalool " tree and is thence carried to the rest of the plant. Therefore in young trees no " linalool " is obtainable from the wood. It is suggested that this important product might be obtained by utilizing the vigorous sprouting power of " East " camphor trees. Seeds could be sown and seedling sub-varieties other than " linalool " could be pulled out. After one or two years, if these trees are cut down for " linalool " production, the stumps will sprout again and again. This method might also be used to obtain essential oils from other sub-varieties.

The Joyful Gardener. Books about gardens, books about gardening, books about gardeners, books for the amateur, books for the professional, serious or flippant, expensive or (nowadays rarely) of reasonable price, they flow from our presses and, presumably, are purchased and sometimes read. The present work* consists of what may best be described as a series of twenty eight essays on subjects more or less closely connected with horticulture. These essays are of varied length and of varied merit and the subjects are diverse and not always ascertainable from the titles of the chapters. Some are charmingly written and many of them include unusual items of fact, though some statements need checking and some correcting. King Atallus III may or may not have been misjudged by historians, but it is difficult to believe that he could have cultivated in his garden at Pergamus (better Pergamum) the poison ivy, cinchona, and coca plants, since he died in 133 B.C. (Oxford Companion to Classical Literature, 64: 1937) and neither Americans nor Russians claim that the New World had been discovered by that date. Again (p. 248) it would be well for the sake of accuracy to state that

*Agnes Rothery, The Joyful Gardener, Andrew Melrose Ltd. New and Revised Edition, 1951. pp. 272, 12/6d.

modern botanical nomenclature is made by International Rules to date, for the seed-bearing plants, from the Species Plantarum of Linnaeus 1753 (not 1758). There are many pithy sentences scattered through the pages. One appreciates the remark of Thomas Jefferson " But although an old man I am but a young gardener", though he had been learning all his life. The lady who said " it's hard to make flowers look ugly " had probably not seen double tulips in the flower beds at Kew. The longest essay is headed " Four Poets and Four Gardens " and attractively considers the work of John Clare and William Blake and of two much less well-known poets, an Irishman, James Clarence Morgan, and Ernest Dowson.

For the most part, this book makes enjoyable reading and can be especially recommended to those who indulge in reading in bed. On second thoughts, perhaps it is best read in a hammock in the garden, on a day when it is too hot to dig or weed or mow the lawn.

W. B. Turrill.

Australian Rain Forest Trees*—The second edition of the excellent manual bearing this title, by W. D. Francis, has been revised and considerably enlarged. The major part of the increase in size is due to the addition of a second part, occupying 80 pages, which gives an account of the species confined to the tropics that were excluded in the first edition. There appears to be no obvious advantage in keeping the purely tropical species separate, since there is a considerable overlap of species with the sub-tropical rainforests. The separation involves some duplication, especially in the provision of a second artificial key to species. Indication is given in the key to the first part of the species that extend their range into the tropics and it would have been a simple matter to include all in one key. The new photographs of the boles of tropical trees, taken in the field, are excellent. On the whole, the old figures have been reproduced with less contrast and show details of bark structure more effectively, while several have been rearranged with advantage. To one from the northern hemisphere, some of the common names give a feeling of unreality. They are not what they seem. White Hazelwood, for example, is applied to a 100 ft. tree of the *Symplocaceae* (*Symplocos stawellii*) quite unlike our northern shrub, while white Beech is used for *Gmelina* spp. (*Verbenaceae*) far removed from our northern beeches or the aptly named southern beeches (*Nothofagus*). On the other hand, names of local origin, like Wilga for *Geijera* spp. and Quandong for *Elaeocarpus* spp., have a charm and robustness that springs from the soil and have much to recommend them. After the confusion of vernacular names, the scientific names are a relief, but even here a number of changes have been made, necessitated by an increased knowledge of the plants and the application of the International Rules. Three new combinations are made, and are validated in the preface by reference to earlier literature. Elsewhere in the book small additions and alterations have been made and the rainfall map has been revised.

R.M.

*Australian Rain-Forest Trees, W. D. Francis, Forestry and Timber Bureau, Canberra, Australia, pp. xvi + 469, 1951.

NOTES ON CYPERACEAE: XXVIII.*

E. Nelmes

An Addition to the Carex flava Group of Sedges.

When my friends Alston and Sandwith discovered in Central Albania a sedge belonging to the section *Extensae* Fries, the members of this group were not at all clearly distinguished from one another in Britain and in other parts of Europe. During the succeeding sixteen years the limits of these plants in this country have been gradually more and more definitely defined, leading to the general recognition, at present, of four distinct species : *C. flava* L., *C. lepidocarpa* Tausch, *C. demissa* Hornem., and *C. serotina* Mérat. One can state briefly the chief characters distinguishing these yellow sedges by describing the first-mentioned as having crowded spikes with large bent utricles, the second widely spaced spikes with large bent utricles, the third crowded and widely spaced spikes with medium-sized straightish utricles, and the fourth crowded spikes with small straight utricles.

This elucidation of the above-mentioned sedges has led to the recognition of an equal claim to specific status of the Albanian plant, which is described below. It has the small stature and crowded spikes of *C. serotina* but its utricles approach the larger ones of *C. demissa* and they are bent as in *C. lepidocarpa*.

Carex dyrrachiensis *Nelmes*, sp. nov. ; a *C. serotina* Mérat spicis crassioribus, glumis majoribus interdum mucronulatis, utriculis longioribus recurvis vel apice reflexis distinguenda.

Caespitosa. *Culmi* erecti, trigoni, angulis obtusis, 5–20 cm. alti, circiter 0·5 mm. crassi, laeves. *Folia* basilaria, culmo saepe longiora, 1·75–2 mm. lata, planiuscula, rigidula ; *vaginae* albidae, demum brunneae. *Spicae* (3) 4–5, 4–7 mm. longae, terminalis mascula, erecta, circiter 2 mm. crassa, laterales femineae vel androgynaeceae, patulae vel subpatentes, 5–6 mm. crassae, subdensiflorae, superiores sessiles vel brevissime pedunculatae, inferiores breviter et saepe incluse pedunculatae, infima interdum distante vel remota excepta in capitulum terminale aggregatae. *Bracteae* inferiores foliaceae vel subfoliaceae, breviter vaginantes, superiores minores, haud vel vix vaginantes. *Glumae femineae* ovatae, cymbiformes, apice subacutae vel obtusae, circiter 2 mm. longae, 1·2–1·4 mm. latae, pallidae vel pallide flavidae, latere enerves, vitta mediana trinervi nervis superne coalitis apicem attingente vel breviter excurrente. *Utriculi* ellipsoidei vel obovoidei, subinflato-trigoni, 3–3·25 mm. longi, 1·2–1·5 mm. lati, membranacei, plurinerves, anguste marginati, glabri, demum patuli vel patentes, plerumque recurvi vel apice reflexi, pallide viridi-flavidi vel flavidi, basi vix stipitati, apice subsensim vel subabrupte rostrati ; *rostrum* acuminatum compresso-conicum circiter 1 mm. longum bidentulatum ore haud obliquum ; *dentes* stricti vel leviter convergentes. *Achaenium* obovoideum, trigonum, 1·3–1·5 mm. longum, 0·8–1 mm. latum, demum brunneum, vix valde stipitatum, tenuiter breviter rostratum. *Stylus* basi vix incrassatus. *Stigmata* 3.

*Continued from K.B. 1951, 422 (1952).

Central Albania : Durrës (Durazzo), marshy spots on sand-dunes at sea-level, 30th Aug. 1935, *Alston & Sandwith* 2736.

The following notes on the habitat, locality and associates of *Carex dyrrachiensis* are contributed by Mr. N. Y. Sandwith.

This *Carex* was found growing in bushy and rushy slacks, dry in summer, at the back of the sand-dunes near the Banjo Popollore (Public Bathing Establishment), about 2 miles east of the town of Durrës (Durazzo). The bushes are of *Myrtus communis* and *Erica verticillata*, and among these are patches of marshy ground with *Aster albanicus* (a rare species, previously unknown from this locality), *Gratiola officinalis*, *Lippia nodiflora*, *Juncus acutus*, *J. Tommasinii*, *J. maritimus*, *J. anceps* subsp. *herzegovinus*, and the *Carex*.

Ecology of some plant communities in Ceylon*—In Ceylon there are large areas not covered by closed forests. A considerable amount of ecological research has been carried out on these by several investigators, with sometimes divergent conslusions. The present author* maintains that the savannas, grasslands, and fernlands of the island are all communities derived from closed high forest, or in other words they are not climatic climaxes. Seven major classes of such secondary vegetation are recognized, as follows :

1. *Talawa* grasslands, or ' grasslands intermixed with trees " ;
2. *Kekilla* (*Gleichenia linearis*) fernlands ;
3. Dry *patana* grasslands, i.e. grasslands of the hills ;
4. Open savannah forest ;
5. Wet black *patana*, in the wet hill country over 5,000 ft.
6. Dry *damana* grasslands, in the dry low country below 1,000 ft.
7. Wet *villu* grasslands, in the dry low country below 1,000 ft.

The climax vegetation in the areas now occupied by these communities it is claimed is naturally closed forest of the wet evergreen type in the first four, subtropical wet montane forest in the fifth, and tropical dry mixed evergreen forest in the last two. The now existing communities are of biotic origin, arising from clearing, burning, and cultivation, and, after abandonement, by periodic burning.

The evidence brought forward by Dr. Holmes in favour of the above views is varied. Some of it is in the form of direct observations recorded by him over a period just less than a decade. Other lines of evidence include ascertained history, archaeological remains, philology, and the results of analyzing and comparing the vegetational communities themselves.

The paper is illustrated by 28 figures, from photographs, of varying merit, and one diagram. There is also a map showing the distribution in the southern part of Ceylon of the communities described.

W. B. Turrill.

*The Grass, Fern, and Savannah Lands of Ceylon, their Nature and Ecological Significance, by C. H. Holmes, Imperial Forestry Institute, University of Oxford, Institute Paper, No. 28, 1951, pp. 95, 29 figs., map, 20/-.

MIOMBO BARK AND ITS USES IN EAST AFRICA.

L. D. E. F. Vesey-FitzGerald.

(Senior Scientific Officer, International Red Locust Control Service).

The almost limitless woodlands of western Tanganyika appear to be singularly lacking in natural resources and they are, moreover, infested by the ' tse-tse ', *Glossina morsitans*, throughout. The human population has never been abundant and natives are nowadays forbidden to occupy large areas on account of sleeping sickness transmitted by the fly. In consequence the woods, which are dominated by two genera of trees, *Isoberlinia* and *Brachystegia*, remain practically uninhabited.

These trees are of even height and even spacing and they cast a dappled shade over the soil of hundreds of square miles of Central Africa. But the monotony of the woods is broken by areas of wooded grassland in which the genus *Combretum* is well represented and these in turn fringe open grassy plains and wandering river beds and swamps where rank marsh herbage abounds.

During the latter part of the dry season bees are busy amongst flowering trees, wild animals frequent the quiet glades around the grassy plains and fish are concentrated in pools in the swamps which remain during the rainless months. The woods are therefore a happy hunting ground for wandering food-gathering folk who fashion their tackle and chattels almost entirely from the bark of trees. Game hunters have in recent years adopted muzzle loaders and bows and arrows of local manufacture are not nowadays so often seen. But the honey hunters' needs are still provided by the bark of trees and their craft demands a variety of articles.

The first necessity is a hive and for this purpose a mature tree with a smooth bole is selected, usually of the species *Isoberlinia paniculata*, and from this cylinders of bark five feet long are prised off by completely ringing the tree. The scaly outer bark is shaved away and the vertical cut edges are pegged together so that a perfect cylinder is formed. The ends of the cylinder are then closed with discs of inner bark neatly sown in place with bast so that only a small apperture is left as a bee entrance. The hive is then thatched with grass, which is bound in place with bast, in order to keep the interior cool and it is then set horizontally in the top-most branches of a convenient tree. Great numbers of such hives are made and set out, especially in the vicinity of water, during the months before the main flowering season of the trees. The wild bees' nests are often found in natural cavities of rocks and trees and these nests are free to any one who finds them. But the bees also make use of the bark hives and the ownership of these is strictly observed by the honey hunting fraternity.

When the honey season is at its height the gatherers are busy in their camps. It is usual for the honey to be taken at night, though the African is singularly regardless of stings and will always take a wild nest whenever it is found whether by day or night, in spite of the reputation for fierceness which the African bee enjoys. When about to take a nest the hunter provides himself with a smouldering log or a brand made of dry canes bound together and then climbs to the hive in the tree top. After quietening the bees with smoke the hive is lowered to the ground on a

stout rope made from the inner bark of a *Brachystegia* tree. It seems that the disturbed bees are unable to recognise their hive on the ground but return to its former site in the branches, thus leaving their precious store of honey to the mercy of the hunter.

The comb is then removed from the hive and carried back to camp on a bark platter. In the camp a variety of bark utensils are needed. The honey comb and brood combs are sorted out onto different trays and the honey is squeezed from the waxen cells by hand. During these processes neat bark troughs are used as receptacles for the honey. These consist of concave strips of *Isoberlinia* bark which are shaved on the outside and have the ends folded up and pleated and held in place with wooden skewers. The residual comb is collected in buckets made from cylindrical strips of bark with the seam and bottom neatly sown up with bast.

The wax is next melted in an earthen pitcher over a slow fire and when liquid it is poured into a ' sock ' made of woven bast. When the ' sock ' is full it is squeezed between two sticks and the golden wax streams through the meshes leaving all impurities behind. Bees-wax is the great ' cash-crop ' of the ' miombo ' woods.

The honey meanwhile is poured into large gourds for transport. These are obtained from the vine *Lagenaria vulgaris*, a plant of the cucumber family which produces natural demi-johns. The bottle-gourds are grown in the cultivations far from the hunting grounds and are thus almost the only piece of apparatus which the hunter does not find or manufacture in the wild-woods. In former years the four-gallon petrol tin was much used but now that petrol pumps are replacing tins the product of the ' bark-age ' culture is returning to favour ! Only a very small portion of the honey crop finds its way to an outside market as it has a great local demand in the form of ' mead '.

Conical huts are made from bark sheets and logs, the whole structure being thatched over with grass to darken the interior. Inside these cool shelters the hunters find protection by day from robber bees which would otherwise swarm over the combs and honey pots—and by night the hunters sleep there in safety from marauding lions.

The bark industry provides many small chattels for both the household and work. Funnels, scoops and ladles of perfect form are produced by the bottle-gourd vine. Bark bins hold stores of grain ; but perhaps the most interesting is the bark blanket. For blanket manufacture the bark of a *Brachystegia* in the *B. longifolia* group is used. Only trees of a certain age and growth are selected and test slashes are made on many trees before the perfect one is found. In fact it is surprising how many trees throughout the virtually uninhabited woods are seen to have been sampled and left to rot compared with the number actually destroyed to supply the demands of blanket makers.

When a suitable tree has been found the bark is stripped off in sheets, only the inner bark being suitable for the purpose. This is pounded as it dries until it is as pliable as woven material. Separate sheets are then sewn together with thin strips of bast and a perfect blanket or cloak is made.

Bark also contributes to the fisherman's craft. Light wood-skin canoes are used on all the shallow lagoons in the swamps and some of them are

The Author examines trees stripped of their bark near a honey hunter's camp in the Kibondo district, near Kaberi swamp. *Phot. A. A. Bullock.*

A bark bee-hive in position in a tree-top near Uvinza, Tanganyika Territory, overlooking the valley of the Malagarasi River. *Phot. A. A. Bullock.*

[*To face page 70*

Hut, beehives in various stages of manufacture and other articles at a honey-hunter's camp, Kibondo district, near Kaberi Swamp. The African is wearing a bark blanket. *Phot. A. A. Bullock.*

New beehives at a honey-hunter's camp. The lids fit tightly but are not sewn in position and the bee entrance is at the other end. Kibondo district, near Kaberi Swamp. *Phot. A. A. Bullock.*

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of perfect construction. As before the whole trunk of a selected *Brachystegia* tree is skinned in such a way that the bark strip retains the natural convex form of the trunk. One end of the trough-shaped length is then pinched together and sewn in place to form the forward portion of the canoe and an exactly similar piece is prepared for the stern section. The two halves are then placed with their open ends together, sewn with bast strips, and a slender canoe ten feet or so in length takes shape. Wooden struts and bearers are then tied in place so that the vessel retains its form and no lighter or more slender boat could be devised in which to traverse the shallow water.

Bark fibre is also used for the manufacture of the fishing nets in general use and these, together with the paddles, batons, fish traps, fish spears, drying frames, packing baskets and other necessities, all of which are made from bark and brush wood, show that the fisher folk are as dependent on the ' bark-age culture ' as the other wandering hunters who find their livelihood in the great ' Miombo " woodlands.

Flowering Trees of the Caribbean.*—This book, which was sponsored by the Alcoa Steamship Company, is designed for tourists visiting the West Indies and the neighbouring shores of the American mainland, and expensively fills a real need. The trees selected were chosen because they were either spectacular, or common, or important ; in effect, many of the more famous and obvious trees of the gardens and landscape of this region have been lavishly and beautifully illustrated in colour. Accompanying each plate are two or three pages of text which very pleasantly describe each tree and give much information on its history, uses and distribution, the derivation of its Latin name, and a geographically arranged list of its local names. These accounts—it is not clear who wrote them—were prepared, we are told in the introduction, with the help of the staff of the New York Botanical Garden, where " hundreds of hours of research " were spent. A little more help would have saved the printing of some dreadful blunders, such as, " In the order *Labiateae*, the pea and bean are not unwholesome " (p. 22), " George Bentham, an Australian " (p. 52), and the statement that " about twelve " species of *Cordia* occur in America (p. 105), as well as a number of amateurish confusions and misprints. The correct name for the " Fern Tree " is *Jacaranda rhombifolia*, and why is Richard Spruce described as a " poor but dignified Scot " ? Again, the very odd bibliography is much too extensive, and many of the references are quite irrelevant for all but the most scholarly travellers. Still, this is a beautiful book, which will interest and delight not only those who are undertaking their first Caribbean adventure but also the less fortunate who are living on memories. N.Y.S.

*Flowering Trees of the Caribbean. Paintings by Bernard and Harriet Pertchik. Introduction by William C. White. Rinehart and Co. Inc., New York and Toronto, 1951, pp. xii., 125, pl. 30 (six-colour printing). Price $10.00.

South African Plants.*—The publication of the second edition of Dr. Phillips's " Genera " is an event of major importance. The first edition appeared a quarter of a century ago and was largely a compilation from earlier works. The present edition is in the same format but embodies a vast amount of original and critical work and includes the additions to the flora of South Africa discovered since the first edition appeared, and the few omissions from that work. There is a key to families and keys to the genera in each family. There may be some criticism of the omission of tribal names and diagnoses in the larger families such as *Gramineae*, *Leguminosae* and *Compositae*, since in such families it is difficult to avoid errors and ambiguities in an ordinary dichotomous key and the provision of tribal " stops " would be of assistance in the avoidance of errors by the user.

The generic diagnoses are supported by the citation of the type-species of the generic name in every case. This must have involved a vast amount of nomenclatural research by Dr. Phillips and he is to be congratulated upon this notable attempt to stabilize the generic nomenclature of the South African flora. His nomenclatural researches have led him to the examination of a world-wide literature and he has thereby noticed a number of papers which could be readily overlooked by workers on South African botany. These are incorporated in an extensive bibliography (pp. 857–905) arranged under the families and genera with which they are concerned.

The actual arrangement of the main body of the text follows that of Dalla-Torre and Harms and the genera receive the numbers given by them. Additions are interpolated in their correct systematic positions, and receive the same number as the previous Dalla-Torre and Harms genus, with the addition of a roman ' a ', ' b ', ' c' etc., as may be appropriate. In most genera this is satisfactory, but in others, such as *Mesembryanthemum*, the system is abandoned and here no fewer than 64 genera receive the number 2405 without qualification. Incidentally, the number 2405a is given to a list of further genera of *Mesembryanthemeae* incompletely known to the author, including 73 names! Dr. Phillips is to be congratulated upon his courage in treating the *Mesembryanthemeae* in this way, where many would attempt to make a good-looking but useless key!

The whole work is one of permanent value and will remain a standard work for a generation at least. Printers' and proof-reading mistakes are few and the letter-press is well spaced and easily read. There are a few citation errors in the bibliography, but these are rarely serious. By present-day standards it is excellent value at £2 and should be in the hands of all botanists and horticulturists interested in South African plants.

A. A. Bullock.

*"The Genera of South African Flowering Plants." Second Edition. By E. P. Phillips. Memoir No. 25, Botanical Survey of South Africa, pp. 923. Government Printer, Pretoria. 1951. £2.

THREE NEW SPECIES OF GONYSTYLUS FROM BORNEO.

H. K. Airy Shaw.

Gonystylus areolatus *Domke ex Airy Shaw*, sp. nov. perinsignis, foliis elongate oblongis insigniter areolato-bullatis, inflorescentia robusta rhachi crassissima, floribus magnis usque 1·5 cm. diametro petalis circiter 40 staminibus circiter 80 distinctissima.

Frutex? (vel *arbor parva*?), ramulis robustis 5–10 mm. crassis, cortice fusco ut videtur laxo. *Folia* in genere maxima, 40–50 × 7·5–10·8 cm., oblonga (rarius oblanceolato-oblonga), basi longiuscule angustata, apice subrotundata, breviter deflexo-acuminata vel cuspidata, chartacea, subtus undique breviter parce pilosa, supra glabra, siccitate ochraceo-castanea vel supra viridula, costa robusta subtus tereti 3 mm. crassa supra anguste impressa, nervis perconspicuis supra bullato-impressis subtus argute prominentibus late patentibus in foliis angustioribus subrectis in foliis latioribus procurvis 1–3 mm. a margine conspicue arcuato-anastomosantibus laxe dispositis (in folio 40 cm. longo primariis circiter 30-jugis), inter primarios secundariis vel minoribus 1–5 interpositis, omnibus ope venularum brevium transversarum conspicue connexis reticulationem pulchre areolatam efficientibus ; petiolus brevis, crassus, 15 (–30) × 5 (–10) mm., rugosus, fere glaber. *Inflorescentia* terminalis, anguste pyramidali-thyrsoïdea, 10–21 cm. longa, fulvo-tomentella ; rhachis 3–5 mm. crassus ; ramuli 1-2·5 cm. longi, patentes vel reflexi, pluriflori ; pedicelli usque 4 cm. longi, alabastro incrassati, sub anthesi 1–2 mm. crassi. *Calyx* (floris expansi) 1·5–1·8 cm. diametro, extra brevissime adpresso-tomentellus, segmentis deltoïdeo-lanceolatis obtusiusculis 9–10 mm. longis sub anthesi reflexis intus densissime setulosis. *Petala* ± 40, subulata, 6–7 mm. longa, glabra vel nonnunquam parce setosa, pustulata (pustulis in alabastro manifestis in flore aperto aegre visibilibus). *Stamina* usque 80, filamentis 1 mm. antheris 2 mm. longis anguste oblongis minute asperatis. *Ovarium* (? an semper) 6-loculare ; stylus robustus, glaber vel setosus, paullo supra basin ' parastylis ' 4–5 parvis clavatis glabris 1–1·5 mm. longis instructus, stigmate majusculo cylindraceo-capitato. *Fructus* ignotus.

Borneo. S. & E. Borneo; Samarinda Div., Longiram Subdiv., Upper Mahakam R., Soengei Dengey or Dingay, 1896–7, *Jaheri* (Exped. Nieuwenhuis) 773 (Herb. Bog.).

This remarkable, isolated species (indicated as new by Dr. Domke in Herb. Bogor.) almost merits a distinct section in the genus. The elongate leaves, with their unusual venation, and the massive inflorescence with its large flowers, suggest ' primitive ' features. The ' parastyles ' give the appearance of being actually the vestigial styles of a formerly 5-styled gynoecium, only one of which now remains functional. It is unfortunate that nothing is so far known of the fruit or of the stature of the plant.

For an account of the Nieuwenhuis Expedition, with maps of the Upper Mahakam region, see *Peterm. Geogr. Mitteil.* **44**, 9, t. 2 (1898).

Gonystylus xylocarpus *Airy Shaw*, sp. nov., *G. macrophyllo* (Miq.) A.S. ut videtur affinis, foliis rigide coriaceis apice rotundatis vel brevissime subapiculatis, fructibus globosis eximie lignosis vel fere lapidosis parietibus crassissimis distinctus.

Arbor, 12 m. alta, trunco 1·2 m. ambitu. *Folia* late elliptica, 10–17 ×

4·5–9 cm., basi et apice rotundata vel apice interdum brevissime subapiculata, margine reflexa, rigide coriacea, siccitate brunnescentia, supra subnitentia, glaberrima nisi costa subtus parce puberula, costa supra anguste insculpta subtus robusta, nervis supra crebriuscule reticulatis subtus laxioribus in nervum intra-marginalem distinctum anastomosantibus. *Inflorescentia* robusta, usque 12 cm. longa, rhachi aliquot complanata 3–4 mm. crassa, ramis crassis brevissimis usque 8 mm. longis apice ut videtur multifloris minutissime ferrugineo-puberulis. *Flores* ignoti. *Fructus* globosus, indehiscens (?), usque 7·5 cm. diametro, pericarpio 1·5–2 cm. crasso valde lignoso extra verruculoso, pedicello 2 × 0·7 cm. *Semina* complanato-ovoïdea, usque 3·5 × 2 cm., testa laevi subnitente saturate brunnea vix 1 mm. crassa.

Borneo. Sarawak: G. Ngili Forest Reserve, G. Sadong, 11 April 1924, *Omar* 58 (type, Herb. Singapore); vernacular, *ramin*. W. Dutch Borneo: Singkawang Div., Pamangkat, Paloh, Feb. 1927, *Boschproefst.* bb. 11350 (Herb. Bog. et Lugd.-Bat.); vernacular, *medang belèt*.

Judging by the foliage, this species should be rather close to *G. macrophyllus*; this does not, however, necessarily follow, since *G. augescens* Ridl. is very similar to *G. macrophyllus* in foliage but is widely different in inflorescence. The unusually coriaceous leaves and massive fruits appear to be distinctive. The Sarawak specimen has been designated as type, since it shows the greatest differences from *macrophyllus*; the Pamangkat specimen could conceivably represent an exceptional form of the latter species. Further material is needed to clarify the status of these forms.

Gonystylus acuminatus *Airy Shaw*, sp. nov., foliis siccitate castaneis et floribus basi distincte truncatis *G. brunnescenti* A. S. similis, sed petalis glabris recedens; forma et nervatione foliorum *G. borneënsi* (v. Tiegh.) Gilg similis, sed floribus minoribus forma diversis; ab his et plerisque congeneribus foliis sensim acuminato-caudatis, inflorescentiis (siccitate) subferrugineo-tomentellis, floribus in ramulis lateralibus inflorescentiae racemosim (nec nodoso-fasciculatim) dispositis distincta.

Arbor circiter 25 m. alta, trunco 0·5 cm. crasso. *Folia* oblonga vel lanceolato-oblonga, 12–20 × 3–5·5 cm., basi cuneata, apice in acumen 1–1·5 cm. longum sensim angustata, tenuiter chartacea, siccitate castaneo-brunnea, glaberrima (nisi hinc inde subtus secus costam puberula); costa supra anguste impressa, nervis gracilibus late patulis densiusculis haud valde conspicuis; petiolus 9–12 × 1–2 mm., parce puberulus. *Inflorescentiae* 8–13 cm. longae, graciles, subferrugineo-tomentellae, ramulosae, ramulis racemiformibus pro rata elongatis 0·5 3 cm. longis, floribus dissitis nec nodoso-fasciculatis; pedicelli 1·3–1·5 cm. longi, dense tomentelli. *Calyx* breviter cupuliformis, basi distincte gibboso-truncatus, circiter 4 mm. longus, 6–7 mm. latus, tomentellus, segmentis ovato-deltoïdeis obtusis sub anthesi valde revolutis. *Petala* 20–25, subulata, 2 mm. longa, glabra, epustulata. *Stylus* glaber. *Fructus* ignotus.

Borneo. S. & E. Borneo: Samarinda Div., Longiram Subdiv., W. Koetai, Iboet, alt. 150 m., Nov. 1925, *Endert* 4785 (Herb. Bog.).

A sterile specimen from Kokmoi Forest Reserve, Kedah, Malay Peninsula (*F.M.S. For. Dept. 42435*, Herb. Kepong), is probably, and one from Lampongs, Sumatra (*Teijsmann s.n.*, Herb. Bogor.) less probably, referable to the same species.

NOTES ON ASIATIC GRASSES : I.
Danthonia DC. in India.

N. L. Bor.

In the *Flora of British India*, Hooker f. describes four species of *Danthonia*, namely, *D. himalaica* Hook. f., *D. exilis* Hook. f., *D. cumminsii* Hook. f. and *D. cachemyriana* Jaub. et Spach. Recently a further species, *D. forskalii* R. Br. has been collected in Beluchistan by H. Santapau at Nokhurdi-Amirchi in 1945. This species and two others have been taken out of *Danthonia* by Nevski and now form the basis of the genus *Asthenatherum* (Nevski in *Act. Univ. Asiae Med. sér.* 8*b*, *Bot.*, *fasc.* 17, 8 : 1934) where Nevski also made the new combination *A. forskalii* (R. Br.) Nevski. *Asthenatherum* is certainly distinct from *Danthonia*. The species of which it is so far composed inhabit very hot, arid, sandy places, as opposed to the mountainous rocky slopes favoured by *Danthonia*. The species moreover have extravaginal innovations, chartaceous, scabrid glumes, and lemmas with dense rows of hairs between the nerves on the dorsal surface, in all of which respects *Danthonia* is quite different.

Despite the discovery of the former *D. forskalii*, we are still left with the four species listed by Hooker. The types of three of the species are in the herbarium of the Royal Botanic Gardens, Kew. The remaining species, *D. cachemyriana* Jaub. et Spach, is one of the grasses collected by V. Jacquemont during his travels of exploration in India, 1830–31, and preserved in the Herbarium of the Musée d'Histoire Naturelle in Paris. An account of the new species was given in the *Illustrationes Plantarum Orientalium* by Jaubert and Spach.

Among those figured is the type of this well-known Indian grass, *Danthonia cachemyriana* Jaub. et Spach. The drawing depicts a slender, weak species with small anthers and a hairy lemma, but this grass as described by Hook. f. in the Flora of British India is robust, with very large anthers and a very sparsely hairy lemma, and is not at all like the drawing in the ' Illustrations '. Hooker disposes of the discrepancy in size and other characteristics in the words "Jaubert and Spach's figure is of a very starved small form ". The folders of *D. chachemyriana* at Kew are filled with this robust grass and the two sheets of Jaubert and Spach's which are preserved at Kew also contain this robust species.

Apart from the great discrepancy in size, there are other points of difference in the description of Jaubert and Spach which cannot be explained by saying that one is a starved form and the other is not.

It was considered that the type of *Danthonia cachemyriana* Jaub. et Spach should be seen and the Director of the Herbarium of the Musée d'Histoire Naturelle was kind enough to send it to Kew for examination.

The type specimen conforms exactly to the drawing in the Illustrationes. It bears the label

Danthonia cachemyriana Jbrt. & Spach
Illus. Pl. Orient.
(In fissuris rupium montium excelsorum :
Augusto 1831)
Cachemyr
no. 1041. Voyage de V. Jacquemont aux
Indes orient.

In the Illustrationes the specimen is cited as—

ad rupes editissimas Emodi Cachemyriani
legit Jacquemont, augusto anni 1831
(Herb. Mus. Par.)

Despite the difference in wording the Paris sheet is to be taken as the type since it corresponds exactly to the drawing in Illustrationes, Jacquemont was in the Vale of Kashmir in August 1831, and no other specimen of *Danthonia* was collected on this occasion.*

The two sheets of *Danthonia*, collected by Jacquemont, in the Herbarium at Kew were " donné par le Muséum d'Histoire Naturelle de Paris ". Both of the sheets bear the name *Danthonia cachemyriana* Jaub. et Spach. in a different handwriting from that on the type.

The labels on these two sheets read as follows :—

1. Sheet 258.

Danthonia cachemyriana Jaub. et Spach
var. vaginis hirsutis
in altioribus 3500–3800 m. between Lipa and Pangi,
Kunawar *V. Jacquemont* 2068

2. Sheet 260.

Danthonia cachemyriana Jaub. et Spach
in nemoribus altissimis
Buspa Valley
V. Jacquemont no. 2139

Both of these places are to be found in Bashahr, one of the Simla hill states. The Bispa river flows into the Sutlej just south of the village of Chini. Kanawar is the upper or north eatern subdivision of Bashahr and consists of some very steep and rugged country. Jacquemont visited these places in 1830, that is, in the year previous to his visit to Kashmir.

The species which is affixed to each of these sheets is the robust species of *Danthonia* which is so common all along the Himalaya, and both specimens have been named in Paris as *D. cachemyriana* Jaub. et Spach.

These are the only sheets of *Danthonia* from Jacquemont's collections at Kew, and Hooker, who was not in the habit of sending for type specimens, assumed quite naturally that they had been correctly named and were robust specimens of Jaubert and Spach's small, starved grass. Thus it came about that all the specimens at Kew which conformed were named *D. cachemyriana* Jaub. et Spach.

In the collection of *Danthonia* at Kew there are a number of specimens of a slender *Danthonia* to which Hooker gave the name *D. exilis* Hook. f. This species matches exactly the specimen which is the type of *D. cachemyriana*. It is quite inexplicable how Hooker came to overlook the fact that his *D. exilis* matched in all essential details the drawing of *D. cachemyriana* in the *Illustrationes*. Whatever may have been the reasons for this error, we have in future to call the slender Himalayan *Danthonia* by its proper name, *Danthonia cachemyriana* Jaub. et Spach.

For the robust species, which does not appear to have a name, one

* Private communication from Mlle. A. Camus.

Photograph of the type specimen of *Danthonia cachemyriana* Jaub et Spach.

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cannot do better than call it *D. jacquemontii*, in honour of the intrepid traveller who discovered it and whose tragic death in Bombay at the age of 31, brought to an end a career which promised great things.

D. himalaica Hook. f. is a perfectly good species easily distinguishable from the others on account of its firm golden-brown glumes, long membranous ligule and hairy ovary.

The remaining species described by Hooker, *D. cumminsii* Hook. f., must be merged in *D. jacquemontii* Bor, as it cannot, by any reliable characteristics, be kept separate from this species. Indeed, Hooker, himself, remarked " possibly a form of *D. cachemyriana*, but the characters are marked ". Actually I cannot find any difference between *D. cumminsii* and *D. cachemyriana* of the *Flor. Brit. Ind.* var. *minor*. It is exactly like Hooker's type of this variety, except that the culms of the variety are decumbent. I have, therefore, no hesitation in making the reduction.

Generic Description.

Danthonia *DC.*

Spikelets laterally compressed, pedicelled in ample or contracted panicles, rarely in racemes ; rhachilla disarticulating above the glumes and between the florets, usually produced and carrying a rudimentary floret. *Glumes* persistent, equal, rarely unequal, lanceolate or elliptic when flattened, acute or acuminate, herbaceous and hyaline on the margins to somewhat firmly chartaceous, 3–9-nerved, with nerves anastomosing. *Florets* 2–5, hermaphrodite, the uppermost reduced, usually male ; callus large, flattened, bearded. *Lemmas* rounded on the back, usually membranous, hairy, but the hairs sometimes arranged in tufts at the base of the lobes between the veins, 7–9-nerved, awned from the sinus ; lobes lanceolate or acuminate, with a long or short bristle from the tip ; awn flat, glabrous or shortly hairy, strongly twisted below the knee, slightly twisted above ; *palea* elliptic, 2-toothed, 2-keeled. *Lodicules* 2, hairy on the upper margin. *Stamens* 3 ; *anthers* often large, linear, orange-red. *Ovary* oblong or obovoid, glabrous or very shortly hairy ; *styles* 2, distinct ; *stigmas* plumose ; *grain* oblong or obovoid ; *hilum* linear-oblong or linear-punctiform.

Caespitose perennials with narrowly linear, rolled, almost setaceous leaves ; ligule a thick, short fringe of hairs or membranous, long, pointed or almost acuminate.

Key to the Indian species of *Danthonia*

Glumes firmly chartaceous, golden-brown ; ligule well-developed, membranous, up to 7 mm. long . . . . . 1. *D. himalaica*

Glumes membranous, greenish, shining or suffused with purple ; ligule a dense row of short hairs :—

Slender grass ; panicles very short, congested ; glumes 10–12 mm. long ; anthers 1·25–1·5 mm. long ; lemma with tufts of hair between the nerves at the base of the lobes . 2. *D. cachemyriana*

Robust grasses ; panicles long, congested or racemose ; anthers 3·5–5 mm. long ; lemma hairy on the margins :—

Glumes 18–25 mm. long . . . . . 3. *D. jacquemontii*
Glumes 15 mm. or less long . . . . *D. jacquemontii* var. *minor*

1. Danthonia himalaica *Hook. f.*, Flor. Brit. Ind. **7,** 81 (1896).

A perennial grass with many stems from a thick woody rootstock. *Culms* up to 45 cm. tall, terete, wiry, smooth and glabrous, solid, 1–2-noded. *Leaf-blades* very narrow, leathery, involute, linear, tapering to a setaceous point, deeply furrowed on the upper surface, very much longer than the supporting sheath, up to 30 cm. long, 1·5–2 mm. broad, flexuous, glabrous and smooth on the lower surface, minutely scabrid on the upper surface ; *leaf-sheaths* very short, rather tight, leathery, striate, smooth and glabrous, with broad scarious margins which are carried up beyond the collar and merge with and are of the same texture as the ligule ; *ligule* membranous, broader than the blade at the base and tapering to an acute or acuminate point, up to 7 mm. long.

Inflorescence a raceme or very simple panicle of pedicelled spikelets, up to 9 cm. long ; axis angled, smooth and glabrous ; pedicels shorter than the spikelets, wider above, pilose. *Spikelets* up to 25 mm. long, wedged-shaped, laterally compressed, 4–6-flowered. *Lower glume* 15–20 mm. long, 4–5 mm. wide when flattened, lanceolate- or elliptic-lanceolate-acuminate in shape, firmly chartaceous in texture, golden brown in colour, 5–7-nerved, smooth and glabrous on the dorsal surface except on the keel which is scabrid ; *upper glume* similar in texture and shape, but larger, up to 25 mm. long and 5·5 mm. wide and 7–9-nerved, with the tip produced into a short bristle. *Callus* of the lemma stout, with an oblique articulation, 1 mm. long, long-bearded with white hairs up to 3 mm. long, the whole seated on a stout, glabrous stipe with a transverse articulation below next the glumes. *Lemma* up to 14 mm. long, rounded on the dorsal surface, thinly chartaceous, 7–9-nerved, sparsely covered on the margins with white hairs in the lower half, scabrid and glabrous in the upper half and on the lobes, bifid to 4 mm. below the tip, awned in the sinus ; lobes lanceolate-acuminate very shortly awned ; *palea* 9 mm. long, 2-keeled, elliptic, bifid at the apex, very narrowly winged on the keels ; *awn* from the sinus, 20 mm. long, flat, covered with very short, coarse hairs, strongly twisted at the base ; *column* darker in shade than the bristle and about half the whole length of the awn ; *ovary* obovoid, very shortly hairy ; *styles* 2 ; *stigmas* feathery ; *stamens* 3 ; *anthers* linear, 4·5–5 mm. long.

Ind. Or. : N.W. Himalaya. Tehri Garhwal, Lokandi Peak, N.E. Side 2,600–3,000 m., 14 Apr. 1894, *J. F. Duthie* 14467 ; Jaunsar, Rock on each side of Lokandi Peak, 2,600–3,000 m., 19 Apr. 1894, *J. F. Duthie* 14467 (Type) ; Jaunsar, Deoban, on rocks 3,000 m., June 1894 ; *J. S. Gamble* 24856 ; Chansil Ridge, 4,000 m., May 1894, *J. S. Gamble* s.n.

The first two sheets comprised the only material of the species at the disposal of Hooker and as he quotes the second sheet it has been selected as the type. Although these two sheets were collected on different days, approximately in the same place, they bear the same number.

D. himalaica Hook. f. differs in some respects from its congeners, principally in the very firm glumes, the hairy ovary and in the long membranous ligule.

2. **Danthonia cachemyriana** *Jaub. et Spach*, Illus. Plant. Orient. **4,** 46 (1851) t.331.

D. exilis Hook. f., Flor. Brit. Ind. **7,** 81 (1896).

A perennial, densely tufted grass, with fibrous roots. Culms up to 25 cm. tall, filiform, erect, sometimes decumbent at the base, several-noded, not branched, terete, smooth and glabrous, glabrous at the nodes. *Leaf-blades* linear-acute, involute, filiform, somewhat flexuous, those of the upper sheath hardly developed, those from the lower sheaths up to 6 cm. long, 1 mm. broad, furrowed on the upper surface and scaberulous, glabrous on the lower surface ; *sheaths* tight, the upper with rudimentary, the lower with normal, blades, the lower somewhat coriaceous, striate, all smooth and glabrous ; *ligule* very short, truncate, membranous, lacerate.

Inflorescence a very short (1–3 cm. long) raceme or panicle of crowded spikelets ; axis of the raceme flexuous, terete or angled, smooth and glabrous, or pilose with soft white hairs ; pedicel shorter than the spikelets, dilating gradually upwards. *Spikelets* 10–12 mm. long, 2–3-flowered, laterally compressed, wedge-shaped, secund on the axis. *Lower glume* 10 mm. long, 2 mm. wide, lanceolate-acuminate when flattened, 3–5-nerved, the outer nerves if present very short, the two inner half as long as the glume and anastomosing with the central nerve, hyaline on the margins outside the nerves, straight on the keeled back, smooth and glabrous, scaberulous on the keel ; *upper glume* 12 mm. long, 2 mm. wide, lanceolate-acuminate when flattened, hyaline on the margins, straight on the keeled back, smooth and glabrous or minutely scabrid on the keel principally towards the apex, 5-nerved. *Lemma* 4·5 mm. long, including callus and lobes, 2 mm. wide, elliptic in shape, cleft at the apex into 2 awned lobes 1 mm. long, the central nerve issuing between the lobes as a perfect awn, 5–7-nerved, with the nerves costate, sparsely hairy on the dorsal surface between the nerves, with dense tufts of hair between the nerves at the base of the lobes, long-ciliate on the margins ; callus 0·5 mm. long, flattened with an obtuse articulation, densely bearded on the edges ; *awns* of the lobes 5·5 mm. long, scabrid ; central *awn* 15 mm. long ; column golden brown, 3 mm. long, flat ; *palea* 4·5 mm. long, elliptic in shape, 2-keeled, scabrid on the keels, 2-nerved, nerves very close below, pilose in the lower half and sparsely pilose on the flaps ; *styles* 2 ; *stigmas* plumose ; *stamens* 3 ; *anthers* 1·25–1·5 mm. long ; *lodicules* 2, very small, obovate-truncate in shape with 3–6 long cilia from the apex ; *rhachilla* capillary, smooth and glabrous, with joints 1·5 mm. long ; *grain* obovoid, flattened, 1·5 mm. long, 0·75 mm. broad ; *embryo* half the length of the grain; *hilum* in the lower half of the grain, narrowly elliptic-oblong in shape.

Ind. Or. : Kashmir, in fissuris rupium montium excelsorum, Augusto 1831, *Jacquemont* (Type) ; Telail, 3,500 m., 24 Aug. 1876, *C. B. Clarke* 30684 ; Sonnamarg in Sind Valley, 2,600–3,000 m., 17 Aug. 1893, *J. F. Duthie* 13616 ; Kishenganga Valley near Gurais, 6 Sept. 1892, *J. F. Duthie* 12599 ; Lahul, Sissu-Koksar, 3,500 m., 3 July 1941, *N. L. Bor* 16625.

3. Danthonia jacquemontii *Bor*, nom. nov.

D. cachemyriana of the Flor. Brit. Ind. **7,** 281 (1896) non Jaub. et Spach.

A caespitose perennial, striate, with a woody rootstock upon which the culms arise, covered at the base with usually long, sometimes short, leathery distichous sheaths, which are fan-shaped in old plants. Culms up to 60 cm. tall, erect from the base, terete, smooth and glabrous, several-noded, not branched, glabrous at the nodes. Leaf-blades long and slender, often filiform, up to 30 cm. long, 2 mm. wide or less, linear, tapering to a long acuminate point, convolute or involute, sometimes flat, smooth and glabrous on both surfaces, or scabrid on the upper surface, or sparsely hairy on the under surface with soft hairs, deeply furrowed between the veins on the upper surface, striate below, scabrid on the thickened margins ; lower *sheaths* very leathery, yellowish, shining, glabrous or sometimes sparsely covered with soft, white hairs, upper sheaths rather tight, clasping the culms, shorter than the internodes, the uppermost carrying a rudimentary blade, and sometimes spathe-like, subtending the inflorescence, smooth and glabrous, striate, sometimes pilose or somewhat scabrid ; ligule a dense ridge of short hairs.

Inflorescence very variable, ranging from a very dense panicle, 10–12·5 cm. long, with many spikelets, to a few-spiculate raceme 6 cm. long ; axis, pedicels and branches from quite smooth and glabrous to scabrid and pilose. Spikelets 15–25 mm. long, 2–5-flowered, wedge-shaped, shining, awned. *Lower glume* 15–25 mm. long, 3–4 mm. wide, elliptic- or lanceolate-acuminate, membranous, shining, transparent on the margins, sometimes suffused with purple, smooth and glabrous on the dorsal surface, 3–6-nerved, with anastomosis of the nerves, mucronate or finally lacerate at the tip ; *upper glume* similar to the lower glume in shape and texture, sometimes longer and broader, with several more nerves. Callus 0·5–0·75 mm. long, compressed, rounded below, bearded with straight, white hairs up to 3·5 mm. long. *Lemma* rounded on the dorsal surface, 6–6·5 mm. long, up to the base of the central awn, with 2 acuminate, awned lobes 3·5 mm. long, 9-nerved, the three central nerves passing out into the awn, glabrous and smooth on the dorsal surface in the middle, sparsely hairy along the margins, somewhat hairy above at the base of the lobes, membranous in texture ; awns of the side lobes 6–8 mm. long, straight setaceous, scabrid ; central *awn* 22–25 mm. long, of which the lower 3–4 mm. constitute a flat, eventually twisted, column, chestnut-brown in colour ; *palea* about 10 mm. long, narrowly elliptic in shape, 2-keeled, truncate or 2-toothed at the top, scabrid on the keels ; *stamens* 3 ; *anthers* 4·5–5·5 mm. long (in the variety *minor* orange red) ; *styles* 2 ; stigmas plumose ; *grain* obovoid 2·3 mm. long ; *lodicules* 2, cuneate-truncate, ciliate on the upper margin with hairs 1·5 mm. long; rhachilla smooth and glabrous.

Ind. Or. : Kunawar, between Lipa and Pangi, in altioribus, 1830, 3,500–3,800 m., *V. Jacquemont* 2068 (Type) ; Bashahr, Bispa Valley, in nemoribus altissimis, 1830, *V. Jacquemont* 2139 ; Dalhousie, 2,800 m., 17 Sept. 1874, *C. B. Clarke* 22632 ; Ratha near Kothi, 3,000 m., 30 Jul. 1941, *N. L. Bor*; Shafandayar, Raban Valley, *J. F. Duthie* 25019 ; Tehri Garhwal, near Jaulea below Srikanta, 4,000–4,300 m., 8 Aug. 1883,

J. F. Duthie 266 ; Kumaon, Ralave, *Strachey et Winterbottom* ; Tehri, Chitora, 3,500 m., 28 Sept. 1948, *W. Koelz* 22021 ; Tehri, Chansil Range, 3,000–3,500 m., Aug. 1900, *B. B. Osmaston* 23104 ; Kunawar, 16 Aug. 1849, *T. Thoms.* ; Sikkim, Chola, 3,000—3,500 m., 6 Nov. 1849, *Hook. f.* ; Tsomgo, 3,800 m., 22 Aug. 1945, *Dr. Bor's Collector* 892, 550, 570 and 571.

Certain specimens in the Kew collections deviate from the type in the size (length and breadth) of the glumes. They also have in the main very short basal sheaths and very fine filiform leaves. In length of the lemma and in size of anther they are comparable to the type, and while some of them look quite distinct specifically, particularly those with a racemose inflorescence, I do not feel justified in giving them specific rank. Some of these were relegated to what Hook. f. called *D. cachemyriana* Jaub. and Spach, and he created the variety *minor* to accommodate them. Another specimen with a decumbent stem was raised to specific rank and given the name *D. cumminsii* Hook. f. There is no doubt, however, that this specimen is merely an abnormal form of the variety *minor*, growing, as Hooker supposed, under a rock.

These specimens of *D. jacquemontii* may be given varietal rank as var. *minor* Bor, a typo inflorescentia plerumque racemosa, glumis multo minoribus recedit.

Ind. Or. : Tehri Garhwal, Rocks above Jaulea 4–4,800 m., 7 Aug. 1883, *J. F. Duthie* 264 ; Tehri, above Kaytal, 3,000 m., 5 Oct. 1948, *W. Koelz* 22112 ; Punjab-Himalaya, *J. R. Drummond* 21239. Kashmir, Apharwat, above Gulmarg, 3,800 m., 15 Aug. 1929, *R. R. Stewart* 10474. Sikkim, Geumtong, 3,800 m., 2 Sept. 1849 *Hook. f.* (Type) ; Jelep La, 4,600 m., 1 Sept. 1945, *Dr. Bor's Collector* 470, 483, 533 ; Lachoong, Sept. 1849 *Hook. f.* ; Lachoong, 3–3,500 m., 29 Aug. 1849, *Hook. f.*

Cacti.* The first edition of this book was reviewed in Kew Bull. **1938,** 169, and there is not a great deal to add to the comments made then. Prof. Borg wrote his preface to the second edition shortly before his death in 1945, but the book did not appear until 1951. A biographical sketch of the author, with a portrait and list of his publications has been added by Prof. S. L. Vella of the Royal University of Malta.

Compared with the first edition, the book is somewhat increased in size —487 pages and 65 photographic plates as against xi + 419 pages and 46 photographic plates. The number of species described is increased from 1,188 to 1,500 (out of an alleged total of known species of 1,752) and a number of the more recently described genera have been accepted and included. Others have been either excluded or definitely rejected and a list of these appears on pages 60–61.

Again referring to the earlier edition, the correct spelling *Pereskia* has been adopted in place of *Peireskia* and capitalization of specific epithets

*Cacti. A Gardener's Handbook for their Identification and Cultivation. By [the late] Professor J. Borg. Pp. 487 + 65 photographic plates and portrait. Blandford Press, London. 42s.

now follows exactly the recommendation of the International Rules. This may be regarded as retrograde since it is becoming more and more usual to decapitalize all epithets.

The text follows the same plan as in the first edition ; the addition of habitat notes and country of origin would have been a great improvement from a botanical point of view and perhaps also useful to the cultivator. The early chapters of the first edition reappear in a condensed form as a " Preliminary talk on *Cactaceae* " but no essential matter has been omitted and the section on organography should be of assistance to non-botanists in the understanding of the specific and generic descriptions. The final summary of cultural hints (pp. 444-454) deals with each tribe and sub-tribe separately. As in the first edition the index (pp. 457–487) is very complete.

A. A. Bullock.

Trees and Shrubs for the British Isles.*—The keenly anticipated two final volumes of the 7th edition of Mr. Beans well known work on the hardy trees and shrubs maintain the high standard of the first volume. A comparison with the third edition of 30 years ago sheds much light on the progress made in the enrichment of our gardens by the introduction of new species and the establishment of others then precarious in their hold on our soil. The additions are well distributed, although a few of the large genera have received disproportionate accretions, among them *Magnolia*, *Prunus* and *Rhododendron*. Twelve species have been added to *Magnolia* and nineteen to *Prunus* while the account of *Rhododendron*, which took up 51 pages in the third edition, now occupies 142 pages. There are no keys to assist the reader in the identification of a plant and laborious search must be made through all the species of a genus to make an identification. The lack of keys remains the one major failing of this very readable and excellent work. Typographical errors are commendably scarce, though the mis-spelling of the name of the Arolla pine on plate 37 is unfortunately prominent. The omission of the hyphen in *Larix principis-rupprechtii* is a small lapse in nomenclature, but the major departures from modern nomenclature perpetuated in the text have been remedied by a brilliant afterthought. This takes the form of an extensive index in which the nomenclature of the second edition of Rehder's " Manual of Cultivated Trees & Shrubs " is adopted with appropriate cross reference to the text. It is now possible, except for the few occasions where Rehder needs revision, to arrive at the correct names under the international rules. Thus the stigma of incorrect nomenclature, which hung over earlier editions, has been removed, with considerable enhancement to the value of the work. The clear text and excellent illustrations combine to make it both an ornament and an indispensable source of information for the library of every ardent gardener.

R.M.

*Trees and shrubs hardy in the British Isles, by W. J. Bean, Ed. 7. Vol. II F-Q, Vol. III R-Z. London, John Murray, 1951. 42s. each.

NOTES ON CYPERACEAE: XIX*.

E. Nelmes.

A New Sumatran Carex of Subgen. Vignea.

In Note XXIV it was mentioned that not all the *Carices* collected in Atjeh, north Sumatra, in 1937, by Dr. van Steenis, had been seen by me. These missing plants have now come to hand but unfortunately too late to be included in my revision of *Carex* in Malaysia. Among them is an interesting new species.

It is interesting for several reasons. In the first place, members of Subgen. *Vignea* are rare in Malaysia : the species described below and *C. monopleura* Krecz. are the only ones recorded from Sumatra. This is what one would expect if, as the writer has suggested, the genus had its origin in Malaysia, because the *Vigneae* are considered to represent a type of plant which came late in the evolution of the *Carices*. The *Vigneae* have their greatest present-day concentration on the other side of the world from Malaysia—in North America. Secondly, this new *Carex* belongs to a section of *Vignea* new to Sumatra, Sect. *Stellulatae* (*C. monopleura* belongs to Sect. *Elongatae*). We in Britain can think of Sect. *Stellulatae* as being typified by our common bog sedge, *C. echinata* Murr. (*C. stellulata* Gooden.), and Sect. *Elongatae* by the equally common, but stream-side plant, *C. remota* L.

Finally, one comes to the position of the new species in its section. This is mainly a North American group, where occur about twenty species, in the microspecific sense of Mackenzie (North Amer. Flora, 18 : 99–114 : 1931). *C. echinata* itself is the only one of the twenty which occurs outside North America, and this, with its numerous varieties and forms, in Kükenthal's treatment (Engl. Pflanzenreich, IV, 20 : 228–231 : 1909), is known to occur also throughout much of Europe, in west and east Asia, in Australia and New Zealand.

All the above-mentioned sedges are small, sphagnum-loving plants, with very similar flower and fruit characters. In recent years these have been augmented by two new species, each from a new country, each a clearly distinct species, as I think, but similar in general appearance. They are *C. svenonis* Skottsberg, from Hawaii (Acta Hort. Gotob. 15 : 329 : 1944), and *C. perileia* S. T. Blake, from New Guinea (Journ. Arn. Arb. 28 : 102 : 1947). *C. svenonis* differs from *C. echinata* and closely allied American sedges principally in its mucronulate glumes and more strongly nerved, less spreading, utricles, while *C. perileia* is distinguished from all the foregoing by much longer and smooth-margined utricles, and spikes which have so few male flowers that even the terminal, sometimes almost wholly male in the *C. echinata* group, has a wholly female appearance.

The new Sumatran species has the small utricle typical of the majority but its spikes have the wholly female look of those of *C. perileia*. In other characters, however, it is in strking contrast to all its allies. Its much stouter stems are up to more than a metre in height, its leaves are wider, and its inflorescence stouter. It may have been the paucity of male

flowers at the base of the spikes that caused Kükenthal (Bull. Jard. Bot. Buitenz., Sér. 3, 16 : 314 : 1940) to identify this species, in three gatherings by Van Steenis, as *C. nubigena* D. Don var. *fallax* (Steud.) C. B. Clarke, which does not belong to this gynaecandrous section but to the androgynaeceous Sect. *Multiflorae* Kunth.

The specimens from Mt. Losir have taller stems and shorter, stouter, less bracteate, heads of spikes than those from Mt. Kemiri, but the utricles of the latter plant are not sufficiently mature to show whether it is or is not varietally distinct from that of Mt. Losir, which, because of its ripe fruits, has been made the type of the species.

Carex gajonum *Nelmes*, sp. nov. ; affinis *C. svenonis* Skottsb., sed culmis multo altioribus validioribus, foliis latioribus, spica terminali basi floris masculis paucis praedita, glumis femineis longioribus, utriculis latioribus marginibus magis spongioso-incrassatis differt.

Caespitosa. *Culmi* erecti, obtuse trigoni, 20–90 cm. alti, 1–2 mm. crassi. *Folia* subbasilaria, culmis sublongiora, 1·25–2·5 mm. lata, inferiora ad vagina aphyllas redacta. *Spicae* 5–8, gynaecandrae sed floribus masculis paucis, plus minus ellipsoideae, 5–10 mm. longae, 3–5 mm. crassae, densiflorae, suberectae vel patulae, sessiles, aggregatae vel approximatae, infima interdum subapproximata, inflorescentiam oblongam interdum ovoideam 1·5–4·25 cm. longam 4–8 mm. latam formantes. *Bracteae* 1 (–2) inferiores setaceae vel subfoliaceae, ceterae glumiformes. *Glumae femineae* ovatae vel ovato-lanceolatae, cymbiformes, basi incurvae, apice acutae, 3 mm. longae, 2 mm. latae, translucentes, castaneae, marginibus late albo-hyalinae, nervo mediano apicem circiter attingente. *Utriculi* late ovati, plano-convexi, 3·25–3·5 mm. longi, dorsaliter 8–12-nerves, ventraliter circiter 6-nerves, marginibus praecipue basi spongioso-incrassati, basi cordati haud stipitati, apice subsensim vel subabrupte rostrati ; *rostrum* acuminatum, plano-convexum, 1–1·5 mm. longum, latum, marginibus spongioso-incrassatum et sparse scaberulum, medio dorso longitudinaliter brunneo-sulcatum, bidentulum. *Achaenium* ovatum et leviter quadratum, compresso-biconvexum, 1·75 mm. longum, 1·4 mm. latum, demum brunneum, vix stipitatum et vix rostratum. *Stylus* basi incrassatus, persistens. *Stigmata* 2.

Sumatra: Atjeh; Gajo lands, Mt. Losir, middle-summit, streamlet-valley, 3300 m., 2 Feb. 1937, *van Steenis* 8591 (typus, Herb. Kew. ; dupl., Herb. Hort. Bogor.) ; ibid., Mt. Kemiri, summit-plateau, wet mountain fields, 3150–3314 m., 8–9 March 1937, *van Steenis* 9673, 9679.

The history and genetics of cultivated plants. Mendel's experiments with garden peas initiated, after a lag of over 30 years, the modern study of plant breeding in 1900. For a variety of reasons cultivated plants have received much more attention from geneticists than have wild species. The improvement of crops for economic purposes is the main reason for the bias. That material is at hand or easily obtainable, that

conditions of cultivation are already known, and that the problems to be solved are often clearly defined and of limited extent are subsidiary explanations of the preference shown by geneticists for cultivated plants. The basic principles of inheritance are, of course, the same for both wild and cultivated plants, but there are differences in some details and particularly in emphasis and relative importance. Natural selection is not the same as artificial selection. The genes and genoms selected by man are different from those selected by nature. Many, probably the vast majority, of cultivated plants could not survive under wild natural conditions. Man juxtaposes taxa that are geographically or ecologically kept distinct in nature and thereby increases the chance of hybridization, or he deliberately brings it about. By this salving of " weaklings " or " abnormalities " and by accidental or intentional hybridization the gene constitution of cultispecies is often very different, if only statistically, from that of species in the wild. There is no doubt that the study of cultispecies often throws much light upon the history, constitution, and behaviour of wild species. The converse is, perhaps, true even more often.

One of the great names in the history of the study of cultivated plants is that of N. I. Valilov (1887–1942). Trained in Britain under Bateson and Biffen he carried out personally or directed, between the two world wars, an unparalleled series of explorations, observations, and experiments on a wide range of, mainly temperate, crop plants. Some of his work is well-known to English readers thanks to Vavilov's fluency in our language. Many of the published researches of Vavilov and his colleagues have not, however, hitherto been translated from the original Russian. Amongst important papers by Vavilov himself are those that appeared in 1935 in the 2,500-page symposium which he edited under the (translated) title " The Scientific Bases of Plant Breeding'. A very large number of botanists will be glad to have these in English in the translation* by K. Starr Chester and will be indebted to the editor of Chronica Botanica for publishing them in so readily available a form.

In the articles here published we find in one volume a clear demonstration of a width of outlook combined with a mastery of detail that recalls Darwin's " Origin of Species " combined with " The Variation of Animals and Plants under Domestication". The first outlines " Plant Breeding as a Science " and is partly a brief historical summary and partly a statement of aims. The second, with the title " Phytogeographic Basis of Plant Breeding" condenses and brings up-to-date (1935) Vavilov's views on centres of origin of the major crop plants. The third is, perhaps, that of the widest general interest to botanists since it deals with " The Law of Homologous Series in the Inheritance of Variability ". That parallel mutations occur in taxonomically related taxa had been shown (e.g. by R. R. Gates) before Vavilov first published his results and views on homologous series. In the present paper the conclusions reached regarding regularities of variation are :

1. Species and genera that are genetically closely related are char-

*Selected Writings of N. I. Vavilov. The orgin, variation, immunity and breeding of cultivated plants. Translated from the Russian by K. Starr Chester ; Chronica Botanica 13, Number 1/6 (1951), pp. VII. 366. Waltham, Mass.: The Chronica Botanica Co.; London, W.C. 2 :Wm. Dawson & Sons, Ltd. Price $7.50.

acterized by similar series of heritable variations with such regularity that knowing the series of forms within the limits of one species, we can predict the occurrence of parallel forms in other species and genera. The more closely related the species and Linneons in the general system, the more resemblance will there be in the series of variations.

2. Whole families of plants in general are characterized by definite cycles of variability occurring through all genera and species making up the family.

The importance of Vavilov's views for taxonomists is suggested by the following extracted paragraphs :

" Existing systems of Linneons and varieties must be re-evaluated according to their harmony with a general plan. An important problem of systematics appears to be to work out a single system, based on specific differences of species and varieties and their radicals, along with the analysis of homologous series of variations within the limits of species.

Instead of having in mind innumerable forms named for the place where they have been found, or in honour of persons, there is opened up the possibility of developing a system of species and genera. This is a problem for biology of the future, requiring extensive differential works for the different groups of species and genera. Without such differential works there cannot be fundamental synthetic works. In order to integrate, it is necessary to differentiate. Historically this course is inevitable."

The last two papers are the longest. " The Study of Immunity of Plants from Infectious Diseases " deals with a very important practical subject and includes a comprehensive bibliography. " The Scientific Bases of Wheat Breeding " gives many details of a subject on which Vavilov and his colleagues have done so much research on material collected from all wheat-growing parts of the world. It will be a most valuable work of reference to all who are concerned with the genus *Triticum*.

Enough has been said to prove that Vavilov's researches are of prime importance to geneticists and botanists alike and that this book should be most widely read by all who are interested either in plant genetics or in the methods and concepts of the new systematics. The writer recalls many meetings with N. I. Vavilov, especially at Kew and Merton before the first world war and again on his visits to this country after 1918. He recalls especially a conversation alone with him in the Library on what was to be his last visit to Kew. Vavilov spoke so openly that it was no surprise to learn some years later that he was no longer *persona grata* to the Soviet régime. His death at what should have been the height of his scientific powers and capacities was a great loss to genetics, to taxonomy, and to the study of cultivated plants. No doubt he will one day be hailed as a hero of science by his own countrymen after the wheel of Soviet recognition has made a few more revolutions. Meantime this volume is welcomed for its contents and as a memorial volume to a great scientist and a courageous personality.

W. B. Turrill.

ON THE DISTRIBUTION OF PISONIA GRANDIS R. BR. (NYCTAGINACEAE), WITH SPECIAL REFERENCE TO MALAYSIA.

H. K. Airy Shaw.

Pisonia grandis R. Br. (including *P. sylvestris* Teijsm. et Binnend.) is a species apparently almost entirely confined, in the wild state, to small often uninhabited islands. Originally described (as far as binomial nomenclature is concerned) by Robert Brown (1810 ; see synonymy, p. 96) from islands in the Gulf of Carpentaria[1], it has since been recorded from as far east as the Tuamotu Archipelago, in the Pacific[2], and as far west as the Mascarene Islands[3] and Seychelles[4], in the Indian Ocean, but its occurrences are always extremely scattered. The form with pale yellowish foliage, generally known under the name *Pisonia alba* Span.—the " lettuce-tree " or " cabbage-tree "—is widely cultivated in the Malaysian region, but is evidently not specifically distinct from the wild *P. grandis*.

Rumphius' Account

The earliest, and in some respects still the most comprehensive, account of the tree is that given by Rumphius (1750, 193). Rumphius, writing primarily of the Moluccas and Central Malaysia generally, described the plant under the name *Olus album insulare*, or " the wild potherb-tree of the islands ", and also provided (*l.c.* tab. lxxix, fig. 1) a rather crude illustration of a leafy branch and a quite erroneous figure of the supposed fruit. (See also Merrill, 1917, 216). The following is a rough translation of his interesting account, which may serve as an introduction to what follows.

" The wild white *Sajor-tree* grows nowhere except on small sandy islands, and occurs much more frequently than the preceding cultivated species [*Olus album domesticum* Rumph.=*Pisonia alba* Span.]. It is a far taller tree, rearing itself by means of a number of trunks united a little above the root, where the tree is of such thickness that two men can scarcely embrace it with their arms. Its bark is white, brittle and soft ; the wood also is white, soft, sappy and brittle. The leaves resemble those of the cultivated kind, but are slightly longer and more acute, and are never so yellow, but are always green. From short racemes there hang a number of berries, joined together and acuminate, when half ripe recalling the fruits of Cloves, whose capitula [buds] are divided into five tips and appear pentagonal, which open into small white reflexed florets, bearing 8 or 10 thickish stamens, beneath which grow the fruits, not unlike the very small *Canarium* fruits of the tree which is called *Canarium minimum*[5], but they are softer and more acute, and marked with very many projecting veinlets and as it were raised ridges, and are hairy.

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[1]Pisonia or Turtle Island, off the eastern end of Mornington Island, in the Wellesley Group. See Flinders, 1814, 153–7. A photograph of the type material is given by Setchell, 1924, t. 35 B.

[2]For detailed distribution in the Pacific, see St. John, 1951.

[3]As *Pisonia viscosa* Balf. fil. (1877).

[4]As *Calpidia macrophylla* Bojer (1842).

[5]*Canarium minimum* is apparently *Nanarium minimum s. oleosum* Rumph. *op. cit.* **2**, 162 (1750), which is *Canarium oleosum* (Lam.) Engl. ; cf. Merrill, 1917, 303.

" The trunk generally has in its lower portion certain hollows, resembling bowls or basins, in which rain collects, and from which animals and men may quench their thirst, for it is always sufficiently cold and clear, so long as the bottom is not disturbed, or if these hollows have previously been cleaned, as is observed by those who spend some time on such small islands, on which there is no other drinkable water to hand. Indeed such great natural hollows and cavities often occur which can yield and contain several pitcherfuls of water, and these hollows are also full of this water in the dry months.

" *Locality.* It only grows on small uninhabited islands, such as, in Amboina, Nussa-Cassa [Noesa or Poelo Kasa, Piroe Bay, Ceram], and Pulo-Anan, both called ' pigeons' islands ' ; Pulo-Swangi [Soeanggi] in Banda [S. of Ceram] ; Nussa-Pinjo, commonly called Lussapinjo, two groups of low sandy islands, situated in the southern part of Amboina ; Nussa Lembu or Salembo, off the south side of Borneo [half way between Seletan (S.E. Borneo) and Sapoedi (Madura)] ; Gunungapi [Goenoeng Api on P. Sangeang] off Bima[1] [N.E. part of Sumbawa], etc. This tree, however, is also found on certain mountains (if indeed it is one and the same species), and as I believe in the mountains of Leytimor [S. peninsula of Amboina], but in this mountain species, as far as I know, fruits are not observed, so that it only differs from the cultivated sort in the green colour of the leaves.

" *Uses.* The leaves of this are not, or rarely, used in the preparation of food ; for they are more bitter than those of the cultivated kind, although some use the younger leaves, boiled once or twice in water, as a *sayor* or potherb ; but there are no uses for the mountain species, though some people affirm positively that the cultivated kind was raised from this wild one by repeated transplantation, and this seems to me to be quite probable. For in the Moluccas, and especially in Batsjan [Batchian], as also in Manado [Celebes], as mentioned earlier, the inhabitants make the palisades for their fortresses from these trees, which they cut down and prepare in the mountains, where they are frequent, and these felled trees, or their transplanted branches, bear elegant yellow leaves no different from those of the cultivated kind. In Baley [Bali], also, a species of this tree grows, called by them the black *Sel*, which bears small whitish flowers, and fruits like Cloves, and which I think is one and the same as the above ; for its leaves are likewise not employed for food."

Javanese Localities

Before proceeding to consider the general distribution of *Pisonia grandis*, reference may be made here to what little information is available regarding its occurrence in two or three of its known localities in Malaysia.

In Java, the species has long been known on an almost inaccessible rock, known as Karang bandong, standing in the sea off the south-east corner of the island of Noesa Kambangan, Res. Banjoemas, Central

[1]It is possible that this is an error for the small volcanic islet of Goenoengapi in the Banda Sea, 60 miles N. of the island of Wetar, where Dr. van Steenis informs me that *Pisonia grandis* actually occurs " in plenty ". The G. Api indicated by Rumphius, on Pulo Sangeang, off Sumbawa, is a volcano of 1,949 m. altitude, on an island 10 miles across—not the usual kind of habitat favoured by *Pisonia grandis*. There is also a Goenoeng Api on the small island of Pulo Ai in the Banda group, S. of Ceram, where *P. grandis* may well grow.

Java. This was one of the localities from which Teijsmann (1855, 349–56) re-described it, as *P. sylvestris* Teijsm. et Binnend., in a long and interesting article recounting, among other things, some of the legends concerning its connection with the coronation of the former kings of Java. Further remarks on this locality are given later (pp. 93–4). The species is now known (*teste* van Steenis *in litt.*) on a number of the small islands lying off the north coast of Java.

Philippines

In the Philippines *P. grandis* was unknown until some 35 years ago, when it was discovered by Merrill (1923, 134) on the very small island of Bancoran, in the Sulu Sea, almost due east of the southern point of Palawan. Merrill states that " the enormous trees [were] forming a gregarious forest entirely covering the island to the exclusion of all other trees ". It is still unknown from any other locality in the Philippine archipelago, though it has been recently found in the Talaud Islands to the south-east of Mindanao (Holthuis & Lam, 1942).

North Borneo

In the Kew Herbarium there is a specimen collected by Governor Creagh in April 1895 on Mabul Island, 50 miles due east of Tawau, North Borneo, and quite recently Mr. H. G. Keith, Conservator of Forests in North Borneo, has sent material of the same species from the coral island of Sibuun (or Sibuan), about 28 miles to the north of Mabul. It was this material which gave rise to the present note. Sibuun is about 230 miles south of Bancoran, and the three islands curiously enough lie almost in a straight line running north and south. In a subsequent letter Mr. Keith makes some interesting observations, which are worth reproducing.

" The island (Sibuun) on which I collected this material is the first place I have encountered *Pisonia* in all the years I have been here . . . . It is a most impressive tree—one of the most impressive, in its own way, I have ever seen—with its short bole of great girth, its enormous spreading crown with huge straggling branches and its very soft wood. The particular island (Sibuun) is the resort of great numbers of the Pied Imperial Pigeon[1] [*Ducula* (*Myristicivora*) *bicolor* (Scop.); cf. Chasen, 1935, 19 ; Delacour, 1947, 102] and is uninhabited except for periodical visits by *Orang Palau*, a race of sea gypsies, who use the island as a place on which to dry fish. The island appears to have been inhabited for brief periods in the past as evidenced by abandoned clearings, but these clearings may well have been made by *Orang Palau*. The crown of a large *Pisonia* covers a large area and it is possible that it is confined to low coral islands as it is intolerant to both competition and shade. There is something about the tree, to me at any rate, that suggests Polynesian origin, which might account for its ' patchy ' distribution out this way, and it may owe its distribution to man. It is described as having sticky seeds which could also account for its occurrence on coral islands that are visited by such birds as the Pied Imperial Pigeon that moves over considerable areas."

[1]Cf. the " pigeons' islands " in Amboina, mentioned by Rumphius (p. 88, *supra*).

In his field notes Mr. Keith states that the wood is very soft and light and is said by the East Coast Bajaus (who call the tree *buluh*[1]) to be very durable in sand and used to mark graves. The tree grows to a considerable girth (12 feet), with large exposed roots ; the twigs are very brittle, with a large pith.

General Distribution

The geographical distribution of *Pisonia grandis* is unusual and interesting. Its occurrences on small remote islands, as mentioned earlier, range from the western Indian Ocean to the eastern Pacific. Thus, in the Indian Ocean it is known from a number of the islands to the north and north-east of Madagascar, including the Seychelles[2], Agalegas[3] and Rodriguez[4] ; from the Laccadive[5], Maldive[6] and Chagos[7] archipelagos ; from the Andaman [8] and Nicobar[9] Islands ; and from Cocos-Keeling[10] and Christmas Islands[11] to the east.

In Malaysia, if the two last-mentioned islands be included, the known localities may be pictured as forming a roughly equilateral triangle with its base running almost due east and west. Starting from Cocos-Keeling and Christmas Is., this base-line runs *via* the islands around western Java[12] through the Lesser Sunda Islands[12] to the Tanimbar[12] and Aru[13] groups ; then, turning sharply north-west through the Banda Arc, the north-eastern side runs *via* the islands around Ceram[14], through N.E. Celebes[15] and the Talaud Islands [16], to the islands around North Borneo[17], carried still further north-west by a recent record of the species from the Paracel Islands [18], south-east of Hainan, and extending finally to Pratas Island, or reef[19], south-east of Hongkong in the China Sea. This last is probably its most northerly known ' Malaysian ' locality, unless it occurs also in the Pescadores[20], off the south-west of Formosa. St. John (1951, 228, and map), gives a ' literature ' record for the south-east of Formosa, but I have not traced this. The north-western side of the triangle is represented by a single locality only—Pulo Tioman[21], off the

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[1]Is this cognate with *puruhi*, given by Nadeaud (1873, 46, 85) as the Tahitian name for *P. grandis* ?

[2]Baker, 1877, 263 ; Hemsley, 1919, 143–4, 146–8 ; Summerhayes, 1931, 287.

[3]As *Calpidia macrophylla* Bojer (*Pisonia macrophylla* (Boj.) Choisy 1849, non Link 1821) ; see synonymy, p. 96 infra.

[4]As *Pisonia viscosa* Balf. fil. ; see synonymy, p. 96 infra.

[5]Prain, 1893 *a*, 58.

[6]Willis & Gardiner, 1901, 91.

[7]Willis & Gardiner, 1931, 304.

[8]Kurz, 1877, 279 ; specimen from Middle Andaman, *Kurz*, in Herb. Kew. ; Prain, 1893*b*, 49, 74 ; but *cf.* Parkinson, 1923, 222.

[9]Prain, 1892*a*, 172.

[10]Forbes, 1885, 30.

[11]Ridley, 1906, 215.

[12]Teijsmann, 1855, 353–5 (as *P. sylvestris* Teijsm. et Binnend.) ; van Steenis *in litt.*

[13]Bargagli-Petrucci, 1901, 617.

[14]Rumphius, 1750, 193 ; Merrill, 1917, 216 ; van Steenis *in litt.*

[15]Van Steenis *in litt.*

[16]Holthuis & Lam, 1942, 110, 120, 134, 179.

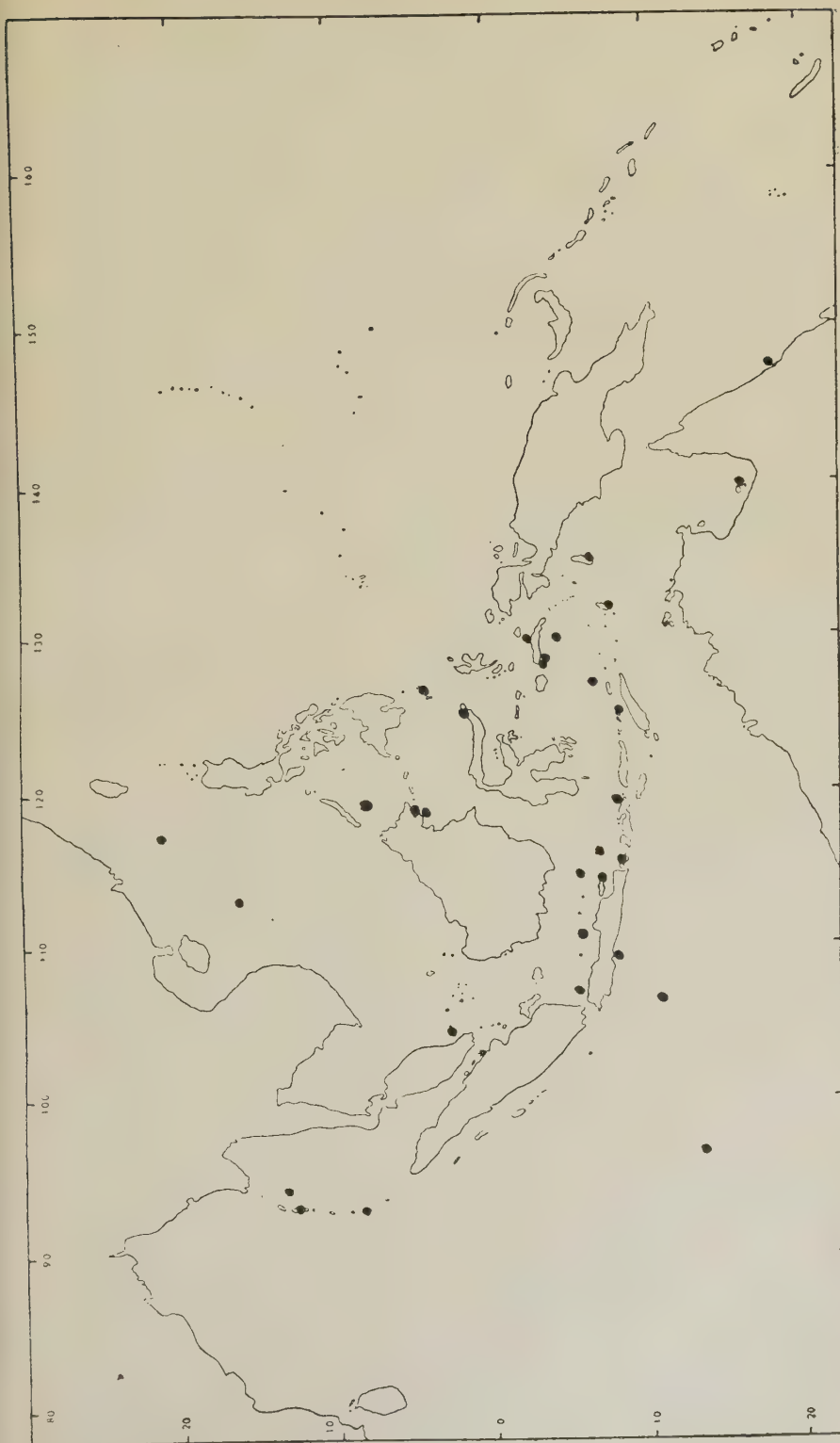
[17]Merrill, 1923, 134 ; Airy Shaw, *hoc loco*, p. 89.

[18]Chang, 1948, 77–8, 81.

[19]Pratas Island, April 1858, *C. Wilford* 448 (Herb. Kew.) : " A single shrub about 5 ft. high. Fl. green." Seemann, 1865, 195 (as " *P. inermis* Forst.") ; Hayata, 1913, 156.

[20]*Not* cited by Tashiro, 1895, 169.

[21]Pahang : Pulau Rengis, P. Tioman, on rocky island, sea level, 16 August 1935, *Corner* (Singapore Field No.) 29788. Not listed by Henderson, 1930, 80–93.



Map showing known distribution of *Pisonia grandis* R.Br. in Malaysia.
(Pacific localities omitted; for these see St. John, 1951).

coast of Pahang, in the Malay Peninsula, lying almost exactly midway between Cocos-Keeling I. and the Paracel Is.

P. grandis occurs again in Queensland (on islands in the Gulf of Carpentaria, and off the east coast), and as far north as Marcus Island, N.E. of the Marianne Islands ; thence it extends eastwards across the Pacific to the Marquesas, Mangareva and Pitcairn (*vide* St. John, 1951, map). St. John (*l.c.* 226) comments on the striking coincidence of the northern and southern limits of the species with the Tropics of Cancer and Capricorn. This is certainly borne out in the Malaysian region, for Pratas Island lies in 21° N. latitude (the Pescadores are actually on the Tropic of Cancer), and the Capricorn Group, off the east coast of Queensland, which apparently represents the most southerly known locality, lies, as its name implies, right on the Tropic of Capricorn, at 23° 30′ S.

Possible rôle of Bird-guano

It is evident that a distribution such as this must depend on some unusual and peculiar factors. Certainly no other *Pisonia* behaves in quite the same way, and very few other species of plants with a comparable distribution are known.[1] It is difficult to believe that it can be entirely due to the ease with which these curiously soft-wooded, almost succulent trees can be destroyed. That birds might be in some way responsible for it would seem *a priori* probable, in view of their almost certain agency in the dispersal of the viscid fruits (cf. Forbes, 1885, 30 ; Prain, 1892*b*, 384, 393–4 ; Ridley, 1930, 613–615 ; Fosberg, 1951, 9 ; St. John, 1951, 225) ; but if simple bird-dispersal were the only factor concerned (cf. Merrill in Christophersen, 1927, 42) we should expect *Pisonia grandis* to be a far commoner species than it actually is.

The suggestion is here put forward that *Pisonia grandis* requires, at least for its germination[2] and early development, an abundant supply of bird-guano, associated with coral or other limestone as the basic rock. This condition is, of course, only satisfied in localities habitually used by birds as roosting or breeding-places ; and, from the nature of the islands upon which the *Pisonia* is actually known to occur, it may be surmised that the birds will only use in this way islands that are reasonably free from large mammalian enemies[3]—chief among which St. John (1951, 226) would reckon Man. This would account for the absence of such bird-resorts, and consequently for the absence of the *Pisonia*, from large islands and continental masses.

That these " *Pisonia* islands " are, in fact, the haunt of large numbers of

[1]The most frequent associates of *Pisonia grandis* appear to be *Ochrosia oppositifolia* (Lam.) K. Schum., *Tournefortia argentea* L.f. and *Suriana maritima* L. Cf. also Fosberg, 1949, 89–92, and 1951, 9. Van Steenis (1932, 261, footnote 3 ; 1933, 9, fig. 2 ; 1949, 41, fig. 1) has drawn attention to certain other species which in Western Malaysia show a distinct preference for small islands ; but they do not appear to provide a parallel to *P. grandis*.

[2]Banfield (1908, 208), in an interesting passage, goes so far as to speculate whether the seeds of *Pisonia Brunoniana* (is *P. grandis* intended ?) may " require the presence of animal matter to ensure germination ", owing to the frequency with which birds and animals become entangled and killed by the viscid anthocarps. The idea is perhaps not so fantastic as it sounds.

[3]It is evident that *small* mammals present no barrier to the breeding of these birds : cf. Hague, 1862, p. 239, on rats ; and Merrill (oral communication, 7 July 1950) informs me that rats were also abundant on Bancoran.

birds, such as pigeons, ' boobies ' (gannets, *Sula* spp.) and ' noddies ' (terns, *Anous* spp.), is evident from the references to be found in the literature from Rumphius onwards. The " pigeons' islands " of Noesa Kasa and Pulo Anan, mentioned by Rumphius, have already been referred to. Merrill (1917, 216) mentions the association of *Pisonia grandis* with such ' bird islands ', and Mr. H. G. Keith's remarks on the Pied Imperial Pigeon[1] on the islands off North Borneo have been given above. In Rock's (1916) account of the vegetation of Palmyra Island there are excellent photographs of large numbers of boobies sitting in the *Pisonia* trees and *Tournefortia argentea* bushes (tt. III, IX, XIII), and some notes on these and other birds are also given in the text (*l.c.*, 16, 20, 22). (Cf. also Setchell, 1924, t. 32B.) Balfour (1879, 365 ; sep. p. 64), in describing *P. grandis* as the supposed new species, *P. viscosa* Balf. f., mentions that the tree was " very abundant on a small ledge of coralline limestone on the west side of Frigate Island, where it is the favourite nesting-place of the ' Fou ' [booby, *Sula* sp.] but is not so abundant on the main island."

Christophersen (1927, 61) concludes, as a result of soil-analyses carried out on Palmyra, that " the forests of *Pisonia grandis* are associated with highly phosphatic soils of an acid reaction, and almost entirely composed of organic matter. The presence of a hard pan consisting of coral conglomerate more or less completely transformed into calcium phosphate, is also characteristic." He notes also (*l.c.* 59, fig. 11, a, legend) that " the root system of *Pisonia* is very shallow with a great horizontal development, and apparently does not go down into the coral sand layer to any extent." As he comments (*l.c.* 58), the acid reaction " is a remarkable feature of a coral island soil ". He does not suggest an explanation, but one cannot resist the conclusion that the guano deposits may here be a contributory factor. (In passing, one may note that there seems to be some divergence of opinion as to whether, in the Pacific, *P. grandis* prefers the wetter [*cf.* Taylor, 1950, 178 ; Fosberg, 1951, 9] or the drier [Fosberg, 1949, 90] atolls. In the latter type it is said to be often dominant, but this may be due to the inability of its usual associates to tolerate dry conditions.)

A possible indirect confirmation of the hypothesis that *Pisonia grandis* is dependent on guano for its existence is obtained from some observations of Koorders (in Koorders & Valeton, 1900, 126–7), who in 1891 climbed one of the small isolated rocks known as Karangbandong, off Noesa Kambangan on the south coast of Central Java, where the *Pisonia* had been known for many years, and was regarded by the natives as a sacred tree. I am indebted to Mr. W. C. Worsdell for the following translation.

" The rock, which consists of white, fine crystalline coral-limestone, rises only a few metres above the heavy surge. With the exception of three trees of *Pisonia sylvestris* T. et B. on the flat rock, almost bare of any mould, there is not one other plant . . . . to be discovered . . . . Two of the trees are already dying. One specimen . . . . is still healthy . . . . The tree stands on the southern rock-islet. Fifty years ago, according to my guide, there were twenty trees standing here. At

[1] Other species of *Ducula* that only touch the smaller islands, such as *D. rosacea* (Temm.) and *D. pickeringi* (Cass.), may well be involved, as well as *Caloenas nicobarica* (L.), the Nicobar Pigeon—on which *cf.* Prain, 1892*b*, 394.

present some half-rotted branches and roots, with an extremely thin brown mould (only here and there, otherwise quite bare), indicate the places where the last of the dead trees must have stood. On the northerly situated rock-islet (or rock) I saw fifteen trees. These are all somewhat smaller than, or as large as, the tree measured, described and figured by me. Seen with the field-glasses these trees are at present nearly all abundantly in flower, but bear (now) no fruits. I do not see any young plants on that rock. The rocky coast of Noesakambangan rises steeply up for 100 metres a short distance from this habitat of the sacred trees.'

What may be significant in the foregoing account is the statement that there was practically no soil on the rock and that, whereas there had once been twenty trees, there were now only three and two of these were dying. The possibility is suggested, by this, that for some reason the islets had been abandoned by birds as a regular station ; that the supply of guano had consequently ceased ; and that hence the *Pisonia* was unable to maintain its existence. Why birds should desert such a spot can only be surmised ; possibly a series of exceptionally stormy seasons would make the rock untenable as a roosting or breeding-place. The same agency might also be instrumental in removing the deposits of guano. The accidental introduction of serious bird-enemies would seem very unlikely, though, in view of the close proximity of the mainland, perhaps not altogether impossible.

Objections

However, this is all speculative, and only observation and experiment can elucidate fully the ecology and bionomics of this interesting species. One serious objection that may be raised to the theory here put forward is the fact that the form known as the ' cabbage-tree ' or ' lettuce-tree ' (*Pisonia alba* Span.) appears to be capable of cultivation in the ordinary soils[1] of the larger Malay islands, without the need for bird-guano. All that could be said in reply to this would be that perhaps *P. alba* does in fact represent a biological race with less exacting requirements than the island form. A second objection arises out of the statement by Hague (1862, 243) that " when an island is covered with trees and bushes, the birds preferring to roost in them, there is no opportunity for the accumulation of guano deposits." Is this in fact the case ? Much of the guano would obviously lodge in the branches, but much of it also would inevitably reach the ground, and so perhaps provide sufficient phosphate for the requirements of the *Pisonia*.

There are also a few occurrences of *Pisonia grandis* that do not seem to fit into the guano theory. Nadeaud (1873, 46), for instance, gives this species as occurring in the " grandes vallées humides " of Tahiti, while a specimen in the Kew Herbarium, from Rurutu in the Austral Islands, leg. *H. St. John* 16693, is localised as from " Paparai Valley, woods on steep slope of limestone bluff, alt. 20 meters ", and another, from Guam in the Mariannes, leg. *E. H. Bryan Jr.* 1261, is localised as from a " remnant of limestone forest on edge of village ". These may represent instances of the persistence of formerly coastal plants after the recession of the sea

[1] Prain (1893*a*, 58) says of it : " frequently cultivated in Ceylon (e.g. at Colombo) near the sea—indeed away from the sea it refuses to grow." Trimen (1895, 392) confirms or repeats this.

owing to the uplift of the land-mass, in the manner referred to by Ridley (1930, 170) ; or it may be that there exist in some of the Pacific islands local races that do not require guano (as suggested above for the "cabbage-tree" form), or that obtain their phosphates in other ways. St. John (1951, 226) states that " the tree will grow well on large islands or on upland habitats and does not need a coral soil." The detailed occurrences of *P. grandis* in the different islands would be worth investigation.

Note on Nomenclature and Taxonomy

The three most widespread species of *Pisonia* (*sensu lato*) in the Malaysian and Pacific regions have been subject to great confusion, both taxonomically and nomenclaturally. A discussion of the tangle has been given by Skottsberg (1936, 722–743). The species involved are : *P. umbellifera* (J. R. et G. Forst.) Seem. (*Ceodes umbellifera* Forst., *Pisonia excelsa* Blume), *P. grandis* R. Br. (*P. sylvestris* Teijsm. et Binnend., *P. alba* Span., *P. morindifolia* Wight), and *P. brunoniana* Endl. The first and last have been separated generically from *Pisonia* by Heimerl (1913, 279) as *Calpidia* Thouars, and Skottsberg (1936, 738 ; 1941, 364) has even gone further and separated *P. brunoniana* into the monotypic genus *Heimerliodendron*, whilst replacing the name *Calpidia* Thouars by the earlier generic name *Ceodes* Forst.

Ever since Forster (1786, 75) misidentified a specimen from the Society Islands as the South American *Pisonia inermis* Jacq. (see Skottsberg, 1936, 735), a strange tradition has persisted (apparently originating with Seemann, 1865, 195 ; *cf.* Skottsberg, *l.c.* 736) of using the purely imaginary name " *Pisonia inermis* Forst." for *P. umbellifera* (Forst.) Seem. and even for *P. grandis* R. Br. Prain (1893, 58), recording " *P. alba* Span." from the Laccadive Islands, appears to intend *P. umbellifera*, rather than *P. grandis*. F. B. H. Brown (1935, 74) cites, as a synonym of *Ceodes umbellifera* Forst., " *Pisonia grandis* R. Brown, not *Pisonia umbellifera* Seemann ", and says (*l.c.* 75) " *Pisonia grandis* R. Brown is apparently the same as *Ceodes umbellifera* of Forster ". Not having seen the specimens cited (from the Marquesas, Austral Is. and Tuamotus), I am uncertain which species is actually intended, but Skottsberg (1936, 728, 736) is probably right in identifying it definitely as *P. grandis*, from the flower and fruit characters.

In view of this, and much more, confusion regarding these species, I cannot altogether agree with St. John (1951, 225) that " published records of its occurrence [i.e. of *P. grandis*] can be accepted with confidence ". True, " in fruit it is unmistakable ", but the male plant is less easily recognised, and there is no doubt that *P. grandis* has sometimes been recorded under the names of the other two species, and *vice versa*. Sterile material requires very careful scrutiny before an identification can be ventured upon.

Pisonia grandis can readily be distinguished in the herbarium from *Ceodes umbellifera* and *Heimerliodendron brunonianum*, in the presence of complete material, by its dioecious flowers, subtended by 2–3 minute bracts at the base, and by its spinulose-glandular anthocarps. The leaves are mostly alternate, though they are sometimes opposite or subopposite (but not whorled) on the young shoots. The branches, often of a

characteristic pinkish-brown colour, shrink considerably in drying, causing a peculiar longitudinal wrinkling which is readily recognizable with practice. The leaves are as a rule thinner in texture than those of the other two species, while under a lens, and often to the unaided eye, the fine reticulation of the ultimate veinlets usually forms a clearly visible network.

I wish to express my thanks to Mr. E. Banks, Dr. E. D. Merrill, Professor H. St. John and Dr. C. G. G. J. van Steenis for information and help kindly given in connection with this paper.

SYNONYMY

(with type localities).

Pisonia grandis R. Br. *Prodr. Fl. Nov. Holl.* **1,** 422 (1810).—North coast of Australia (islands in Gulf of Carpentaria).

Pisonia procera Bert. ex Forst. apud Guillemin in *Ann. Sci. Nat.* sér. 2, **7,** 191 (1837).—Tahiti.

Cordia olitoria Blanco, *Fl. Filip.* 123 (1837).—Philippines (cult.).

Pisonia alba Span. in *Linnaea*, **15,** 342 (1841).—Timor (cult.).

Calpidia macrophylla Bojer, [*Hort. Maurit.* 265 (1837), nomen, et] in *Ann. Sci. Nat.* sér. 2, **18,** 188 (1842), descr.—Galega I. (Agalegas Is., Seychelles).

Pisonia forsteriana Endl. ex Walp. et Schauer apud Walpers. Nyctaginaceae, in Meyen, Obs. Bot., in *Nov. Act. Acad. Nat. Cur.*, **19,** Suppl. 1, 403, t. XI? (1843).—Based upon *P. inermis* " Forst." non Jacq.

Pisonia macrophylla (Bojer) Choisy in DC. *Prodr.* **13** (2), 446 (1849), non Link (1821).—Galega I. (Agalegas Is., Seychelles).

Pisonia morindifolia R. Br. ex Wight, *Ic. Pl. Ind. Or.* **5** (2), 1, t. 1765 (1852).—Madras (cult.).

Pisonia sylvestris Teijsm. et Binnend. in *Tijdschr. Nederl. Ind.* **9,** 349, 355 (1855).—Noesakambangan, Java ; Karimoendjowo Is. ; Bali.

Pisonia olitoria Zoll. in *Nat. Tijdschr. Nederl. Ind.* **14,** 154 (1857) (cum varietatibus *hortensi* Zoll. et *sylvestri* (Teijsm. et Binnend.) Zoll.).—Nomen illegitimum alternativum, *P. albam* Span. et *P. sylvestrem* Teijsm. et Binnend. (? et *Cordiam olitoriam* Blanco) complectens.—Java, Bali, Timor, ?Philippines.

Pisonia viscosa Balf. fil. in *Journ. Linn. Soc.* **16,** 19 (1877), **synon. nov.** —Rodriguez and Frigate Is. (Mascarene Is.).

[?*Pisonia mitis* L. *Sp. Pl.* 1026 (1753).—" India ".—This obscure species was based by Linnaeus upon *Pisonia Malabarica, non spinosa*, of ' *Amm. herb.* 582 '. The full title of this work (which is apparently extremely scarce) is : " *Herbarium Ammannianum, secundum methodum Tournefortianam dispositum.* Cam. LL. Scrin. XI.XII.XIII.XIV." Pp. [189-191] 192–636 + [16] pp. index. According to the Catalogue of the Library of the Linnean Society, this formed the second part of a work entitled *Museum Petropolitanum*, the first part being the *Herbarium Ruyschianum* (pp. 1–188). Mr. S. Savage, of the Linnean Society, informs me that Stejneger (1936), ascribes this work to the great naturalist-explorer Steller. On the page cited of the *Herbarium Ammannianum*, under No. 62, *Pisonia Malabarica, non spinosa*, is given the synonym *Dentellariae fructu arbor Madrasp.* Pet. Reference to Petiver, *Op. Hist. Nat. spect.*, **1,** Mus. Pet. Rar. Nat., p. 11, no. 906 (1767), reveals, however, that the full phrase-name of Petiver's plant was *Dentellariae fructu arbor* Madraspat. *spinosa*! Evidently this was *Pisonia aculeata* L., and was cited as a synonym of the unarmed plant through some curious error—presumably through the word *spinosa* being overlooked. The specimen in the Ammann Herbarium is presumably at Leningrad, but that standing under the name *Pisonia mitis* in the Linnean Herbarium is unquestionably merely a form of *P. aculeata.*—See also the note in Seemann, 1865, 195.]

[*Pisonia inermis* Jacq. sec. G. Forst. *Fl. Ins. Austr. Prodr.* 75(1786), non Jacq.—Tahiti.]

[?*Pisonia malabarica* Choisy in DC. *Prodr.* **13** (2), 447 (1849).—Nomen subnudum, falsa ratione e citatione synonymi *Pisonia malabarica non spinosa* Amm. sub *P. mitis* L. in Poiret, *Encycl. Méth., Bot., Suppl.* **4,** 420 (1816), adhibitum.—" In India orientali."]

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(see also Synonymy, p. 96).

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The Agaricales*—For most mycologists Agaric taxonomy is still based on Fries Hymenomycetes europaei of 1874 or Patouillard's famous Essai taxonomique of 1900. Modern studies in this field have been the preserve of a small group of enthusiasts whose labours have meant little more to the rest of the mycological world than a copious crop of new names in the periodic lists of new species and combinations. Nevertheless the past 30 years have witnessed a rapid growth in knowledge of Agaric anatomy and ontogeny which have necessitated radical changes in the traditional classification. Most of the fundamental work has been by French and German workers, much of it published in periodicals not generally accessible outside their country of origin. English speaking botanists are therefore particularly indebted to Dr. Singer for authoritatively summarising the existing literature and devising from it a rational classification of the Agaricales in this attractive and readable work. Probably no living mycologist is better qualified for such a task, certainly none has been able to study Agarics with such single minded devotion in so many continents, Europe, Central Asia, North America and now in South America. His field experience must be unrivalled and he writes without that bias in favour of a system adapted to suit a regional flora which may limit the outlook of less travelled taxonomists.

The book opens with an eloquent appeal for a wider interest in systematic mycology and a convincing demonstration of its utility to non-taxonomists. From chemical and physiological literature he cites examples to show that " the more artificial a classification, the longer the pertinent facts will remain hidden ; the faster the progress in taxonomy the more guidance will be available for investigators in neighbouring fields engaged in studies on organisms belonging to this particular taxonomic group." Probably it is in part a desire to secure small homogeneous genera serviceable in this way that has led the author of late years to propose so many segregates from the more comprehensive genera of earlier workers. The deep rooted prejudice against unnecessary multiplication of generic names should not lead mycologists to discount the value of these homogeneous groups of species even if they feel not all need find expression at the generic level. Pages 12–126 of the book are occupied by an admirable critical survey of the characters of Agarics as the basis of their taxonomy, first the morphological characters, then the colour reactions and other chemical data on which so much stress is laid today. With a balanced judgment rare among the promoters of systems Dr. Singer wastes little space on evolutionary hypotheses and does not pretend to know what the mushroom's ancestors were like a million years ago. Dispassionately he outlines three possible schemes of interrelationship between Agaricales, Aphyllophorales and Gastromycetes but he is too well aware of the possible heterogeneity of all three orders as at present recognised to commit himself to any phylogenetic scheme.

The remainder of the book, from p. 126 onwards is devoted to a systematic arrangement of the families, genera, and sometimes species, of Agaricales recognised by the author. In place of the 3 tribes and 14 series of Patouillard's treatment of Agaricacés or the 6 families of Agaricales in Konrad and Maublanc's latest work (1948) we are pre-

*Singer, R. The " Agaricales " (Mushrooms) in Modern Taxonomy. Lilloa XXII pp. 832. June 1951. Argentine Pesos 120 or $ U.S. 9.

sented with 15 families, 18 tribes and 9 subfamilies, viz : Hygrophoraceae, Tricholomataceae (Tribes Lyophylleae, Clitocybeae, Leucopaxilleae, Resupinatae, Panelleae, Schizophylleae, Lentineae, Hemimyceneae, Myceneae, Biannulariae), Amanitaceae (Tribes Amaniteae, Pluteae), Agaricaceae (Tribes Leucocoprineae, Agariceae, Lepioteae, Cystodermateae), Coprinaceae (subfamilies Coprinoideae, Psathyrelloideae, Panaeoloideae), Bolbitiaceae, Strophariaceae (subfamilies Strophariodeae, Pholiotoideae), Cortinariaceae (Tribes Inocybeae, Cortinarieae), Crepidotaceae, Rhodophyllaceae, Paxillaceae, Gomphidiaceae, Boletaceae (subfamilies Gyrodontoideae, Suilloidea, Xerocomoideae, Boletoideae), Strobilomycetaceae, Russulaceae. Within these are recognised 163 genera, all described in detail, with type species indicated. In comparing this large number of genera with those in recent regional floras it must be remembered that Dr. Singer's work embraces the Agarics of the entire world, a feat not attempted since Patouillard's day. Most modern authors have not tried to devise workable keys to their systems but Dr. Singer has grappled valiantly with this most difficult problem and offers detailed and careful keys to both families and genera. How far these are workable only experience can show but it is encouraging to recall that the keys to genera in his earlier less ambitious system published in the Schweizerische Zeitschrift für Pilzkunde were the most practicable then available. For many genera keys are also provided to all the species personally studied by the author, supplemented by references to other reliable published keys in recent mycological literature. Finally at the end of each genus will be found notes on its known or likely practical significance as a foodstuff, source of antibiotics, component of mycorrhizas etc.

In a short notice one cannot indicate all the important or novel conclusions adopted in such a monumental work. A few selected almost at random must suffice to indicate its quality. On the vexed question of *Montagnea* (*Montagnites*) Dr. Singer concludes : " *Montagnea* is, indirectly, related with the Coprinaceae. However, if there is such a thing as a Gastromycete, i.e. unless we proceed dividing all the Gastromycetes among other groups, *Montagnea* is one of them." *Lachnella* Fr., which Nannfeldt has already shown to be typified by *Peziza alboviolascens* A. & S. ex Fr., is adopted as a genus of reduced Tricholomataceae and as such it naturally falls near *Chaetocalathus* Singer. Similarly *Cymatella* Pat., *Flagelloscypha* Donk apud Singer, gen. nov. (based on *Cyphella minutissima* Burt) and *Physolacria* Peck are all treated as reduced Tricholomataceae in tribe Hemimyceneae. The old problem of separating *Marasmius* from *Collybia* is solved by interpreting the former in the sense of *Androsaceus* Pat. and typifying the latter by *Agaricus dryophyllus* Bull. ex Fr. The remaining species formerly placed in these genera are divided mainly between *Micromphale* Nees ex S. F. Gray and *Marasmiellus* Murrill. The latter is a somewhat comprehensive assemblage including many species with non-amyloid spores formerly placed in *Mycena* or *Omphalia* as well as *Marasmius ramealis* and its allies. *Hemimycena* (Singer) Singer thus becomes a synonym of *Marasmiellus*.

Dr. Singer has striven loyally to follow the International Rules of Nomenclature even where he thinks them unfortunately conceived and he may therefore reasonably hope that his findings may be generally

acceptable. Apart from the perennial disagreement of authors as to what characters qualify a group of species for generic rank, however, there remains one obvious bone of contention, namely the typification of the old comprehensive genera, founded mainly on the subgenera of *Agaricus* recognised in the successive works of E. M. Fries. Dr. Singer adopts rigidly the so-called residue method, by which the old genus is typified by one of the species left in it after all subsequent authors have sliced off sections and raised them to generic rank. The result commonly is that the old classic genus is left as the smallest of its segregates, often that which contains the least known species. Thus *Hypholoma* becomes typified by *H. candolleanum* (Fr.) Quél. and disappears altogether from binomial nomenclature as a mere subgenus of *Psathyrella* (Fr.) Quél. Meanwhile the well known members of the original genus, *H. fasciculare* (Huds. ex Fr.) Quél. and their allies appear as species of *Naematoloma* Karsten 1879. *Lentinus* Fr. 1825 which in Saccardo's Sylloge embraces 288 species becomes typified by the temperate fungus *L. lepideus* Fr. and reduced to 9 species whilst the tropical fungi which Fries himself indicated as its typical members are divided among the later genera *Panus* Fr. 1838 and *Pleurotus* (Fr.) Quél. In passing, however, one should note that our author has made a serious attempt to find an acceptable morphological basis for separating these three much confused genera. Even while one disagrees with his conclusions one is forced to recognise the enduring value of the work on which they are based. *Armillaria* (Fr.) Quél. is no doubt a thoroughly artificial genus and its former species are here distributed among *Tricholoma*, *Calocybe*, *Armillaria*, *Melanoleuca*, *Leucocortinarius*, *Pleurotus*, *Catathelasma*, *Oudemansiella* and *Armillaria* sensu stricto. The last named retains only two species and is typified by *Agaricus luteovirens* A. & S. ex Fr. Now the majority of botanists and plant pathologists are familiar with the names of a mere handful of Agarics but one of them, and almost the only one which is an important and cosmopolitan pathogen, is *Armillaria mellea* (Vahl. ex Fr.) Quél. How much happier it would have been to have typified *Armillaria* by this species, as was perfectly possible, instead of adopting Karsten's half forgotten genus *Armillariella* and ascribing to it nineteen species. Taxonomists immersed in the problems of a single class of fungi often fail to appreciate the obstinate opposition set up by the " practical ", or " applied ", mycologist, botanist or plant pathologist to name changes of well known organisms. It is greatly to be hoped that opposition so aroused will not prejudice the mycological world against this admirable work. Apparently many of the species names under the less familiar genera are new combinations though they are not clearly indicated as such and are liable to be overlooked by the compilers of lists of new fungus names.

These mild criticisms are in no way intended to disparage Dr. Singer's book, but they may remind the user that even the most authoritative work is to be read with a critical eye and that no-one's opinion should be adopted blindly, an attitude with which we feel the author will be in full sympathy. This is not just another system of classification. It is a complete manual of Agaric studies up to 1950 and as such is indispensable to all serious mycologists whether specially interested in Agarics or not. Certainly it should be in the library of every higher educational institution where botany is taught.

R. W. G. Dennis.

NOTES ON ASIATIC GRASSES : II.

The Genus Apocopis Nees.

N. L. Bor.

The genus *Apocopis* was proposed by Nees von Esenbeck in the *Proceedings of the Linnean Society*, **1,** 93 (1841) to accommodate a species which he found in the Indian Herbarium of Dr. Royle. This species he named *Apocopis royleanus* Nees, but since it had been called *Ischaemum paleaceum* by Trinius in the *Mémoires de l'Académie Impériale des Sciences, St. Petersburg*, in 1833, the necessary combination was made by Hochrader in the *Bulletin of the New York Botanical Garden* in 1910, and it is now known as *Apocopis paleaceus* (Trin.) Hochr. This, then, is the species upon which the genus *Apocopis* is based. The name of the genus itself comes from the Greek verb ἀποκοπτειν meaning " to cut off " which doubtless has reference to the truncate lower glume of the sessile spikelet in the various species.

Hochstetter is credited with the authorship of the generic name *Amblyachyrum*, a synonym, in Steudel, *Syn. Pl. Glum.* 413 (1855) which is based upon the annual species *A. mangalorense* (now *Apocopis mangalorensis* (Hochst.) Henr.) to which Hochstetter gave this manuscript name in Herb. Hohenacker. Subsequently Hochstetter published a very full account of this genus in *Flora* **39,** 25 (1856) in which, incidentally, he administers a severe drubbing to Steudel for the " very misleading and faulty description " in which he is at pains to point out, he (Hochstetter) had no part. He ends his account of the genus by indicating that the genus *Amblyachyrum* is allied to and should be placed between the genera *Lipeocercis* Trin. (a later name for *Dichanthium* Willemet) and *Heteropogon* Persoon. Actually, however, *Apocopis* seems to be more nearly related to genera like *Lophopogon*, *Eulalia*, *Eulaliopsis*, etc., genera which are among those which form the section *Eulaliininae* of the subtribe *Saccharinae*.

The genus as at present known consists of eleven well defined species which are found in India, Malaya, Siam, South China and in Polynesia.

Former work on the Genus.

Hackel, in *D.C. Mongr. Phan.* 6, 256 (1889) lists two species of *Apocopis*, namely *A. royleanus* Nees and *A. wrightii* Nees. Hook. f. in *Flor. Brit. Ind.* **7,** 142 (1896) followed suit, keeping Hackel's two species, and adding a third, *A. pallida* Hook. f. Actually the latter is not an *Apocopis* at all, but belongs to the genus *Dichanthium* Willemet.

Hackel recognised that his *A. wightii* was not a single entity, for he subdivided it into two subspecies. The first of these, subsp. *genuinus*, contains var. α *typicus* and var. β *zeylanicus*, perennials, to which Steudel had given the specific epithet *courtallumensis* and var. γ *wrightii*, also a perennial, which is *Apocopis wrightii* Munro. Both *A. courtallumenis* (Steud.) Henr. and *A. wrightii* Munro are distinct species. They are closely related, but differ from one another morphologically, and, also important, occupy two distinct geographical areas. The second subspecies is subsp. *mangalurensis*, an annual, quite different morphologically from subsp. *genuinus*. It is now called *A. mangalorensis* (Hochst.) Henr.

Hook. f. in *Flor. Brit. Ind*, **7,** 142 (1896) maintained the same two species as Hackel, but even went further when he surmised that *A.*

wightii Nees was doubtfully separable from *A. royleanus* (*A. paleaceus*). Actually these two are totally different from one another.

Subsequently Hackel described a peculiar species *A. vaginatus* Hackel. Hooker considered this to be merely a variety of *A. wightii* Nees, thereby creating more confusion in that grossly bloated, composite species. *A. vaginatus* Hackel and *A. mangalorensis* (Hochst.) Henr. are, no doubt, closely related, but the habit of the former, in which the inflorescence is always half-enclosed in the uppermost sheath, is very peculiar. That, in itself, would not warrant specific rank, but it has been found that the anthers in *A. vaginatus* Hack. are cleistogamous and much smaller than those in *A. mangalorensis*. In addition it occupies a restricted geographical range. I have, therefore, considered it to be a good species.

Since the time of Hooker and Hackel, six additional species have been described.

Characteristics of the Genus.

The genus *Apocopis* is characterised by the inflorescence being composed of spike-like racemes consisting of a fragile rhachis at each joint of which is seated a sessile awned or awnless spikelet. The pedicelled spikelet, typically present in the *Andropogoneae*, is reduced to the pedicel, which itself is fused to the margin of the lower glume of the sessile spikelet; a rudimentary spikelet is very rarely seated on the pedicel. The flat or convex, spathulate, truncate, smooth not ridged, lower glume is very typical of the genus and there is only one species which deviates somewhat in this particular, namely, *A. cochinchinensis*. In this species the lower glume is terete and 7-ribbed, the ribs corresponding to the seven nerves.

In all species the lower glume is 7-nerved. The nerves usually anastomose with one another and may all end below the upper margin or one or more may reach the upper margin and project as small points. It has been found that each species has its own special arrangement of nerves in the lower glume, and that this arrangement is within limits constant for a species ; it is, therefore, of great importance in indentification. As an example, the species *A. paleaceus* (Trin.) Hochr. may be cited. In the lower glume the two outside pairs of nerveson each side fuse just below the upper margin and the fused pair project beyond the margin as a small point or mucro. This feature is absolutely constant for this species and has not, so far, been observed in any other. Each species in turn has its own characteristic nervation which, if not so definite and marked as in *A. paleaceus*, is sufficient to distinguish it from its congeners.

Two of the species, *A. paleaceus* and *A. collinus* are described as awnless. This is true of *A. collinus* as far as the meagre collection of material shows. In *A. paleaceus*, of which considerably more material has accumulated, it is only partially true. In the Khasi Hills it is not uncommon to find this grass well and truly awned, but while the awnless form is also very common in the Khasi Hills, the awned form has not been seen and collected elsewhere.

Generic Description.

Apocopis *Nees*

Spikelets oblong to obovate in outline, flattened or rounded on the back, rarely terete, solitary at the nodes of a fragile rhachis of a spike-like

raceme, sessile, accompanied by a pedicel which is partly adnate to the lower glume of the sessile spikelet, usually without a spikelet, occasionally with a rudimentary glnme or glumes or rarely surmounted by a rudimentary spikelet, the whole plexus, joint, sessile spikelet and pedicel, falling together. Florets 2 in the sessile spikelet, the lower male, the upper female or hermaphrodite. *Lower glume* chartaceous to leathery in texture, obovate or elliptic-oblong in outline when flattened, round, cordate or truncate at the upper margin, light brown, brown or even chocolate in colour with often a lighter band at the top (where the tissues are thinner) which may be light yellow or reddish or even mauve in colour, glabrous and shining or with a coarse covering of hair on the back, 7-nerved ; nerves parallel or slightly arched, free or united in various ways, in one species the two outer pairs anastomose and continue beyond the upper margin as two points, in other species there is a complete ring of anastomosis at the top, with the central nerve reaching the upper margin and excurrent as a short point or ending below the upper margin ; *upper glume* chartaceous in texture, 3-nerved, divided into three equal parts by the side nerves, the central portion containing the median nerve upon which the glume is keeled, and the two flaps outside the side nerves are wrapped round the florets. *Lower floret* always male with two stamens and hyaline palea and lemma. *Upper floret* usually female, less often hermaphrodite, the lemma being linear-oblong with one strong central nerve, and ending in two very short lobes or horns above ; the central nerve issues as an awn above, which may be perfect, i.e., with twisted column and bristle, or rudimentary or even absent altogether ; stamens two only; *styles* 2; *stigmas* plumose; *grain* loose within the upper lemma and palea, elliptic, lanceolate-oblong in outline, terete; *embryo* somewhat less than half the length of the grain; *hilum* basal, punctiform.

Annual or perennial grasses widespread in India, Malaya, Siam, south China and in Polynesia. Inflorescence of two (rarely one or three) spikes arranged digitately at the end of the culms or branches. Leaves firm, lanceolate-acute or acuminate, usually covered with bulbous-based hairs; ligule membranous, short.

Key to the species of *Apocopis*.

Annuals :—

One or more nerves reaching the upper margin of the lower glume :—

Peduncle hirsute below the panicle ; nerves very conspicuous as scabrid ridges on the dorsal surface of the lower glume which is 4–4·5 mm. long, 1·25–1·8 mm. wide . . 1. *A. siamensis*

Peduncle glabrous below the panicle ; nerves of glumes faint or at least the dorsal surface of the glume not ridged :—

Median nerve and at least 2 others reaching the upper denticulate margin of the lower glume, but all close to it ; lower glume 3–4 mm. long, 2 mm. wide, oblong-truncate in shape, glabrous and shining or hirsute ; awn 1·8 cm. long 2. *A. burmanicus*

Median nerve alone reaching the upper margin of the lower glume in a notch or shallow depression and produced as a small point, or all ending below the tip ; awn over 2 cm. long :—

Lower glume 3–3·5 mm. long, 1·25 mm. wide, elliptic-oblong-truncate in shape with a reddish band at the top ; awn 2·5 cm. long . . . . . 3. *A. cochinchinensis*

Lower glume 5–5·5 mm. long, 4 mm. broad, obcordate-oblong in shape with a narrow hyaline band at the top ; awn 4 cm. long . . . . . 4. *A. pulcherrimus*

All nerves ending below the upper margin of the glume :—

Inflorescence concealed within the uppermost leaf-sheath ; lower glume 3·5 mm. long, 2 mm. broad . . . 5. *A. vaginatus*

Inflorescence well exserted ; lower glume 4 mm. long 6. *A. mangalorensis*

Perennials :—

Outer pair of nerves on both sides anastomosing and produced beyond the upper margin of the lower glumes as two points ; spikelets usually unawned but occasionally awned ; lower glume 4·5 mm. long, 2·25 mm. wide . . . . . 7. *A. paleaceus*

Lower glume not as above :—

Lower glume about 6 mm. long and over, chocolate in colour ; spikelets awned . . . . . 8. *A. peguensis*

Lower glume less than 6 mm. long ; yellow or chestnut brown in colour or if reddish then the spikelets awnless :—

Lower glume elliptic-oblong-truncate, 5·5–6 mm. long, 3·5 mm. wide ; spikelets unawned or with a rudimentary awn ; nerves of lower glume not reaching upper margin . 9. *A. collinus*

Lower glume obcordate, obovate-truncate or -rounded ; spikelets awned :—

Lower glume obcordate 4·5–5 mm. long, 3 mm. broad at widest point ; centre nerve and/or side nerve or nerves excurrent or closer to the upper margin than the others 10. *A. courtallumensis*

Lower glume truncate or rounded ; all nerves below upper margin of the lower glume which is 4·5 mm. long, 2·75–3 mm. wide . . . . . 11. *A. wrightii*

1. Apocopis siamensis *A. Camus* in Lecomte, Not. Syst. **3,** 83 (1914).

An annual grass with slender stems. *Culms* up to 45 cm. tall, very slender, smooth and glabrous except below the panicle and just below the nodes which are covered with ascending white hairs, often glabrous below the nodes but always hirsute below the panicle for a distance of 0·5–1 cm. ; internodes longer than the sheaths. *Leaf-blades* linear-lanceolate, up to 5 cm. long, 3 mm. wide, tapering to a sharp point, somewhat acuminate, rudimentary on the topmost sheath, flat, covered sparsely on both surfaces and on the margins below with bulbous-based hairs which are often long, ascending not spreading, with a pronounced midrib which is carried down as a keel on the sheath, serrately scabrid on the margins ; *leaf-sheaths* somewhat inflated, shorter than the internodes, the uppermost without a blade, obscurely keeled, smooth and glabrous in the lower half, hirsute with long, ascending, bulbous-based hairs in the upper half or third, scarious on the margins ; *ligule* a narrow, hyaline membrane about 0·75 mm. long.

Inflorescence a pair of racemes 3–4 cm. long, seated at the apex of a long-exserted peduncle ; peduncle about 10 cm. long, issuing from a spathe-like sheath, hirsute at the top below the panicle ; rhachis of the racemes slender ; joints 1·5 mm. long, compressed, ciliate on both margins with brownish-golden hairs increasing in length from below upwards (4·5 mm. long at the top), carrying at each articulation a sessile spikelet 4·5 mm. long and a pedicel 2·5 mm. long ; pedicel sterile, slender, straight or curved, furnished with long (4·5 mm.) golden-brown hairs, adnate in the lower quarter to the lower glume of the sessile spikelet. *Spikelets* terete, chestnut-brown with a narrow, reddish band at the top of the lower glume. *Lower glume* 4–4·25 mm. long, 1·25–1·8 mm. wide, oblong in shape or slightly wider upwards, truncate at the top with the upper margins somewhat denticulate, 6–7-nerved with all the nerves reaching the upper margin, the outer two often anastomosing, all continued out as small points or teeth, and all quite distinct on the dorsal surface as scabrid (sometimes very scabrid) ridges ; *upper glume* 4·5 mm. long, oblong in shape when flattened, ciliate on the upper margin, 3-nerved, divided into three equal parts by the two lateral nerves, the central portion containing the median nerve, chartaceous in texture, honey-coloured or

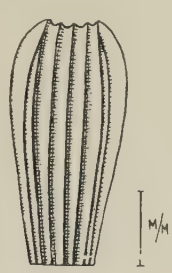

Fig. 1. Lower glume of *Apocopis siamensis* A. Camus.

brownish, somewhat scabrid on the dorsal surface, the two lateral flaps wrapped round the florets. *Lower floret* ♂ or empty ; *lemma* a hyaline, nerveless scale, oblong, truncate, lacerate or fimbriate at the top, 4 mm. long ; *palea* similar but shorter ; *upper floret* ♀ or hermaphrodite ; *lemma* oblong, up to 5·25 mm. long, 1 mm. wide, 2-toothed (teeth rather long), scabrid, 1-nerved, the nerve being continued as an awn ; *palea* 3–3·25mm. long, ovate-obtuse when flattened, faintly 1-nerved, ciliate on the rounded apex ; *awn* 2·5–3 cm. long, of which 1·4 cm. is twisted and chestnut-coloured column, the remainder is antrorsely scabrid bristle ; *stamens* 2 ; *anthers* 2·25 mm. long ; *styles* 2, short ; *stigmas* 4 mm. long, plumose. *Pedicelled spikelet* reduced to the pedicel.

Siam : Wang-Djao " Savannenwald, typisches Gras an feuchten Stellen ", 14 Oct. 1904, *C. C. Hosseus* 145 (Type) ; Hua Hin, 8 Nov. 1927, in open sandy ground, *Kerr* 13499.

According to Mlle. Camus, the nervation of the lower glume approaches that of *Lothopogon tridentatus* Hack., but the texture of the glume is much firmer and the teeth shorter and less hairy. There are only about 5 nerve points at the top of the lower glume, since the two outside lateral nerves anastomose with their immediate neighbours before reaching the summit.

2. Apocopis burmanicus *Narayanaswami ex Bor* in Kew Bull. **1951,** 169 (1951).

A straggling annual grass. *Culms* up to 20 cm. tall, decumbent and creeping at the base, branched, smooth and glabrous, slender, striate, glabrous at the nodes. *Leaf-blades* up to 3·5 cm. long, 4 mm. wide, linear-acute or acuminate, ascending not spreading, with a midrib prominent below and carried down as a keel on the sheath, soft, flaccid, furnished on both surfaces and on the margins with long, bulbous-based hairs which are ultimately deciduous leaving the rough base behind, minutely scabrid on both surfaces and on the margins ; *leaf-sheaths* rather tight, keeled, shorter than the internodes, except below, striate, scarious on the margins, smooth and glabrous in the lower half, beset with bulbous-based hairs in the upper half or third ; the upper sheaths with a rudimentary blade : *ligule* a membrane 0·75 mm. long, lacerate on the upper margin.

Inflorescence of two slender racemes, each up to 3 cm. long. *Racemes* fragile, consisting of a jointed rhachis with a spikelet sessile at each of the articulations accompanied by and partially adherent to a rudimentary pedicel ; joints of the raceme 1·25 mm. long, wider above than below, compressed, glabrous on one surface, pilose on the margins and minutely hairy on the upper part of the other surface ; hairs fulvous-brown, increasing in length from below upwards, very thick at the upper end. *Spikelets* hermaphrodite, sessile at each articulation of the rhachis. long bearded on the callus. *Lower glume* 3–4 mm. long, 2 mm. wide, oblong-truncate in shape, very little wider above than below, narrowly hyaline at the top and along the margins, 7-nerved, median nerve and at least one other reaching the denticulate upper margin, long pilose in the lower three quarters when young, glabrous when older, yellowish with a narrow reddish band above when young, shining deep chestnut brown when older and almost coriaceous, and with the nerves quite obscure on the dorsal surface, not ridged and not scabrid, partially adherent to the pedicel which is 1·25 mm. long, furnished with fulvous-brown hairs 2·5 mm. long ; *upper glume* 3·5 mm. long, 2·5–3 mm. wide, oblong-truncate in shape, 3-nerved, divided into three equal parts by the two lateral nerves, the third nerve bisecting the middle portion, the two flaps infolded, smooth and glabrous, save minutely scaberulous on the central portion, shortly fimbriate on the upper margin, pale yellow to almost brown in colour. *Lower floret* ♂ ; *lemma* a hyaline scale, nerveless, 3 mm. long, elliptic-oblong, truncate on the upper margin ; *palea* a similar scale as long but narrower ; stamens 2 ; anthers 2–2·25 mm. long; *Upper floret* ♀ ; *lemma* 4 mm. long, very narrow, 1-nerved, the nerve becoming stronger and eventually passing out from the entire or two-lobed tip as a stout awn ; *palea* very broad, 2 mm. long, 2 mm. broad, nerveless, hyaline ; awn 18 mm. long of which half is twisted column and half bristle ; column twisted, shortly hairy. *Pedicelled spikelet* absent ; pedicel 1·25 mm. long, partly adnate to the outer margin of the lower glume of the sessile spikelets.

Burma: Rangoon Lake, Dec. 1870, *S. Kurz* 2749 (Type) ; Myodwine, Pegu Yoma, western slopes, in Eng forest, *S. Kurz* 2740 ; Pegu on easy slopes of Gonmin-In grazing ground in Pegu township ; fairly common, on shallow coarse or fine sand, 20 Jan. 1948, *U. Thein Lwin* 453 ; Prome,

" fairly common on shallow coarse sand in *Indaing* forests in the Irrawaddy valley, dry zone" 28 Nov. 1947, *U. Thein Lwin* 368; Road near Wakadow, Lalu Reserve, S. Pegu Reserve, *U. Thein Lwin* 69.

This very weak, straggling species is not uncommon in waste places and on sandy soils.

3. Apocopis cochinchinensis *A. Camus* in Bull. Mus. Hist. Nat., Paris, **25,** 286 (1919).

A slender annual grass. *Culm* erect from the base, almost filiform, simple, smooth and glabrous, up to 40 cm. tall, glabrous at the nodes ; internodes much longer than the sheaths except just above the roots where the nodes are congested. *Leaf-blades* 4 cm. long, 4 mm. wide, usually much shorter and narrower, linear, tapering gradually to an acute point, contracted at the base to the sheath, with a midrib prominent below and carried down on the sheath, glabrous below or with a few to many bulbous-based hairs on the midrib and on the under surface, with many long bulbous-based hairs on the margins, especially below and in the throat ; *leaf-sheaths* much smaller than the internodes, tight, somewhat striate above, smooth and glabrous below, furnished with some bulbous-based hairs above, keeled on the back towards the top ; *ligule* a very short membrane 0·5–1 mm. long, lacerate on the upper margin.

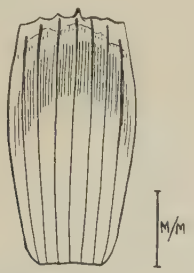

Fig. 2. Lower glume of *Apocopis burmanicus* Narayanaswami.

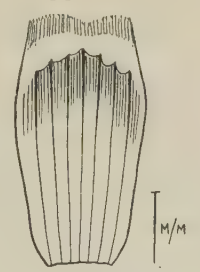

Fig. 3. Lower glume of *Apocopis cochinchinensis* A. Camus.

Inflorescence of two racemes seated on a long-exserted peduncle. *Racemes* up to 2 cm. long, somewhat divergent ; *joints* of the racemes 1·75 mm. long, slender, somewhat thicker at the apex, glabrous and smooth in the middle third, furnished with long and short hairs in the upper and lower thirds, the longest hairs being as long as the joint ; *pedicel* attached to the lower glume in the lowest quarter, 1·75 mm. long, clothed with hairs increasing in length towards the top and the longest hairs being up to 2·5 mm. long. *Lower glume* 3–3·5 mm. long, 1·25–1·75 mm. wide, elliptic-oblong in shape, truncate at the lacerate top with a deep notch in the centre, 7-nerved, the median nerve reaching the bottom of the notch and projecting as a small point, or entire and all nerves ending below the top, the other nerves not anastomosing, smooth and glabrous, narrowly scarious on the margins and from the notch upwards at the top, pale yellow in colour, with a conspicuous new band at the top ; *upper glume* 4·5–5 mm. long, 1·5 mm. wide, 3-nerved, with brown flaps at the side which are wrapped round the florets, truncate at the top, very pale yellow in colour, tinged with red at the top, smooth and glabrous. *Lower floret* ♂ ; *lemma* a hyaline scale 3·5 mm. long, lanceolate-oblong-truncate, nerveless ; *palea* similar in shape, somewhat shorter ; *anthers*

2, 2·5 mm. long. *Upper floret* ♀ ; *lemma* 4 mm. long, 0·5 mm. wide, narrowly oblong, 2-fid at the top with short-lobes, 1-nerved, the nerve becoming stronger at the upper end and finally issuing from between the lobes as a stout awn ; *palea* hyaline, as long and as broad as the lemma ; *awn* kneed 2 cm. long, with column and bristle equal in length ; *column* twisted.

Cochinchina: *Le Pierre* (Type).

4. Apocopis pulcherrimus *Bor* in Kew Bull. **1951,** 168 (1951).

An annual grass with many short flowering culms. *Culms* up to 20 cm. tall, somewhat geniculate at the base, branched, terete, striate, smooth and glabrous. *Leaf-blades*, on sheaths subtending the inflorescences, rudimentary ; those on the culm-sheaths linear-acute in shape, flaccid, green, rough on both surfaces from hairs with bulbous bases, sometimes spiny on the margins with very long or short bulbous-based hairs, running into the sheath, up to 6 cm. long by 5 mm. broad ; *leaf-sheaths* very loose and flaccid, smooth and glabrous, striate, strongly keeled ; *ligule* strongly convex upwards, very narrow, membranous, 0·5–0·75 mm. long.

Inflorescence a pair of racemes seated on a peduncle which is just long enough to exsert the racemes from the supporting inflated sheath ; racemes up to 3 cm. long, at first closely appressed to one another, finally divergent ; peduncle up to 5·5 cm. long, smooth and glabrous. *Racemes* consisting of an articulated fragile axis at each articulation of which are seated a sessile spikelet accompanied by a pedicel devoid of a spikelet ; *joints* of the axis 2 mm. long, angled, ciliate on the angles with longish golden-brown hairs, bearded at the articulations with long and short golden brown hairs ; *pedicel* a flattened stipe 2 mm. long, with or without a rudimentary spikelet, ciliate on the two margins with golden-brown hairs up to 3·5 mm. long, firmly attached to the margin of the lower glume. *Sessile spikelet* solitary at the articulations. *Lower glume* 5–5·5 mm. long, 3·5–4 mm. broad, obcordate-oblong in shape, membranous in texture, hyaline on the margins and at the top, 7-nerved, the median reaching the bottom of the notch at the top, ciliate on the top of the two hyaline lobes ; *upper glume* 5·75 mm. long, oblong in shape when flattened, 3-nerved, divided into three equal parts by the two side nerves, membranous to hyaline at the margins, ciliate at the top. *Lower floret* ♂ or empty ; *lemma* a hyaline scale 5 mm. long ; palea similar but wrapped around the 2 stamens ; *anthers* 0·75 mm. long. *Upper floret* ♀ ; *lemma* 5·5 mm. long, 1 mm. wide, oblong in shape, strongly 1-nerved, chartaceous in texture, minutely 2-lobed above : *palea* hyaline, oblong-truncate, 4 mm. long ; *stamens* 2 ; *anthers* 2·5 mm. long ; *styles* 2, long ; *stigmas* plumose ; *awn* about 4 cm. long ; *column* brown, twisted, about 1·8 cm. long, covered with short hairs.

Burma: Tatkon, 1928, *D. Rhind*, 959 (Type).

5. Apocopis vaginatus *Hack.* in Oesterr. Bot. Zeitschr. **41,** 8 (1891).

A low annual. *Culms* very many, often geniculate at the base, finally erect, up to 15 cm. tall, but usually less than 10 cm., smooth and glabrous, striate, leafy, covered with the sheaths to the inflorescence, glabrous at the nodes. *Leaf-blades* linear-acute, or lanceolate-acute, up to 3·5 cm. long by 3 mm. wide, covered on both surfaces and on the margins with

bulbous-based hairs, scabrid on the margins from the minute teeth and also from the bases of the hairs, with a well-marked midrib which is carried down on the sheath as a keel, erect not spreading, flat, flaccid ; *sheaths* very inflated, the upper enclosing the inflorescence and without a blade, the lower slipping from the culms, smooth and glabrous, save in the upper portion which is covered sparsely with bulbous-based hairs, striate ; *ligule* a very narrow, lacerate membrane.

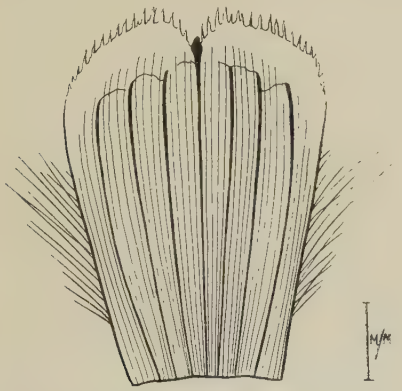

Fig. 4. Lower glume of *Apocopis pulcherrimus* Bor.

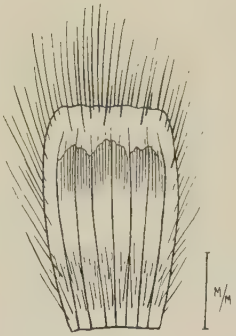

Fig. 5. Lower glume of *Apocopis vaginatus* Hack.

Inflorescence a pair of racemes closely appressed, 2 cm. long, or less, seated upon a glabrous and smooth peduncle, the whole almost enclosed in a spathe-like leaf-sheath ; *rhachis* of the racemes fragile ; joints 1·5 mm. long, slender, terete, somewhat flattened, ciliate on the margins with long brown hairs, densely bearded at the articulations with hairs up to 2·5 mm. long ; spikelets sessile at the articulations, each accompanied by a pedicel. *Sessile spikelet* ; *lower glume* 3·5 mm. long, 2 mm. broad, oblong-obovate or oblong-truncate in shape when flattened, covered on the back with dense golden-brown or chestnut-brown hairs, convex upwards, lacerate or fimbriate on the upper margins, chartaceous in texture, 7-nerved, the nerves distinct and not reaching the upper margin, non-anastomosing, golden about the nerves, hyaline on the upper margins ; *upper glume* 3·5–4 mm. long and oblong-truncate in shape, divided into 3 equal parts by the two lateral nerves, the central portion carrying the median nerve, thin, honey-coloured, shaggy on the dorsal surface. *Lower floret* ♂ ; *lemma* and *palea* nerveless hyaline scales about 3 mm. long ; *stamens* 2 ; *anthers* 0·75–1 mm. long, caught in the stigmas of the styles. *Upper floret* ♀ ; *lemma* narrowly oblong, 3–4 mm. long, 2-lobed at the top, 1-nerved, the nerve being carried out as an awn ; *palea* a nerveless scale 2 mm. long ; awn 1·8–2·4 cm. long ; column 8–12 mm. long, brown, minutely hairy. *Pedicelled spikelet* ; *pedicel* 1·5 mm. long, slender, covered with long brownish hairs.

Ind. Or. : C.P., Hazaribagh, 12 Oct. 1883, 470 m., *C. B. Clarke* 33849B ; do. ibid. 33849J (Type) ; U.P., Dehra Dun, 650 m., Oct. 1892, *J. S. Gamble* 23944. Madras, Bison Hill, Godavery District, 3 Dec. 1902, *C. A. Barber* 5086. Bihar, Parasnath, 18 Nov. 1874, *C. B. Clarke* 24895.

This perfectly good and distinct species has been sunk by Hook. f. with

A. mangalorensis and *A. courtallumensis* under the invalid name *A. wightii* Nees. Apart, however, from its very distinct habit, it is cleistogamous and the anthers are much smaller than those in *A. mangalorensis*. The stamens must be carefully sought for and are usually to be found adhering to the stigmatic hairs. *A. courtallumensis* is a perennial.

6. Apocopis mangalorensis (*Hochst.*) *Henr.* in Blumea, **4,** 523 (1941).

Amblyachyrum mangalorense Hochst. in Flora, **39,** 26 (1856).

An annual grass. *Culms* very many, occasionally up to 30 cm. tall, usually much less, usually geniculate often prostrate at the base, finally erect, branched, slender, terete, smooth and glabrous, striate, glabrous at the nodes, well exserted from the topmost sheath, leafy. *Leaf-blades* 0·5–5 cm. long, up to 4 mm. wide, lanceolate, linear-acute or linear-slightly elliptic-acute or elliptic-acuminate in shape, beset on both surfaces and on the margins with bulbous-based bristles which are longer below, with a well-marked midrib below which is carried down on the back of the sheath as a keel, scabrid on the margins from the minute teeth and also from the bases of the hairs, somewhat erect, flat and flaccid, passing imperceptibly into the sheath ; *sheaths* rather loose, inflated, slipping from the culm, smooth and glabrous, save in the upper part which is covered with bulbous-based hairs ; *ligule* a narrow, lacerate membrane.

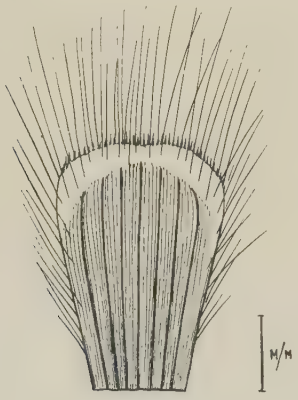

Fig. 6. Lower glume of *Apocopis mangalorensis* (Hochst.) Henr.

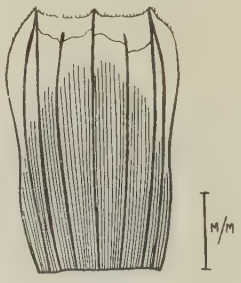

Fig. 7. Lower glume of *Apocopis paleaceus* (Trin.) Hochr.

Inflorescence of two racemes about 2·5 cm. long, seated on a long, exserted, glabrous peduncle ; *rhachis* of the racemes fragile, carrying a sessile spikelet and a pedicel at each articulation ; pedicel occasionally with a rudimentary spikelet, usually devoid of a spikelet ; joints of the racemes 1–1·5 mm. long, terete, somewhat flattened, lower almost glabrous but carrying a few hairs near the top, upper ciliate on the margins, with long brown hairs, thickly bearded at the articulation. *Sessile spikelet* ; *lower glume* 3–4 mm. long, 2–3 mm. broad, oblong-truncate in shape when flattened, conspicuously 7-nerved, coriaceous, with the nerves not reaching the top of the glume, dark brown below, yellowish above, hyaline, often reddish at the upper margin, more or less

hair or completely glabrous on the back, lacerate or ciliate on the upper margin ; *upper glume* barely 4 mm. long, 3-nerved, divided into three equal parts by the two lateral nerves, the centre portion carrying the median nerve, oblong-truncate, lacerate on the upper margin, sparsely hairy on the back, chartaceous in texture, honey-coloured, the marginal flaps wrapped round the florets. *Lower floret* ♂ ; *lemma* a broad hyaline nerveless scale 4 mm. long ; *palea* similar but narrower ; *stamens* 2 ; *anthers* 2·25 mm.long. *Upper floret* ♀ ; *lemma* 3·5–4·5 mm. long, oblong-spathulate in shape, acutely 2-lobed, hyaline below, firm above, 1-nerved, the nerve becoming stronger above and passing out into the awn ; *palea* a hyaline scale 3 mm. long ; *awn* 1·5 cm. long ; *column* 6 mm. long, chocolate-brown, twisted, shortly hairy. *Pedicelled spikelet* absent ; *pedicel* 2 mm. long, slender, ciliate with long golden-brown hairs.

Ind. Or. : Madras ; Chingleput District, Perungudimedu, near Velacheri, 10 Dec. 1899, *A. G. Bourne* 3108, 3109 ; Madras, Western slopes of Nilgiris, Dec. 1899, *A. G. Bourne* ; Malabar, Sholanur, 23 Nov. 1900, *A. G. Bourne* ; Mangalore, 1847, *R. E. Hohenacker* 231 (Type) ; Shimoga, Mysore, Oct. 1908, 650–950 m., *Meebold* 10574 ; Bombay, N. Kanara, Oct. 1890, *W. A. Talbot* 2378. Ceylon, Damboul, Mar. 1868, *Thwaites* C.P. 3959.

7. Apocopis paleaceus (*Trin.*) *Hochr.* in Bull. New York Bot. Gard., **6,** 262 (1910).

Ischaemum paleaceum Trin., in Mem. Acad. Pétersb., sér. 6, **2,** 293 (1833).

Apocopis royleana Nees in Ann. Mag. Nat. Hist. **7,** 142 (1841).

Andropogon paleaceus (Trin.) Steud., Syn. Pl. Glum. 376 (1854).

A. himalayensis Steud., Syn. Pl. Glum. 377 (1854).

Apocopis himalayensis (Steud.) W. Watson in Atkins, Gaz. N.W. India, 392 (1882).

A perennial grass. *Culms* up to 80 cm. tall, branching, smooth and glabrous, slightly striate, erect or slightly geniculate at the base, glabrous at the nodes. *Leaf-blades* linear-lanceolate or lanceolate, acute or long acuminate in robust plants, up to 12 cm. long, by 1 cm. wide, usually only 6 cm. long by 5 mm. wide, hardly contracted at the base, with a very prominent mid-rib which is carried down on the sheath as a keel, flat, flaccid in robust specimens, ascending in weaker plants, more or less covered on both surfaces with bulbous-based hairs, scabrid on the margins ; *sheaths* clasping the stem, eventually rather loose, keeled, striate, glabrous in the lower half, beset in the upper half with bulbous-based hairs, scarious on the margins ; *ligule* very short, truncate, erose.

Inflorescence of 2–4 erect racemes, each raceme consisting of a fragile rhachis with a sessile spikelet and a barren pedicel seated at each articulation ; joints of the rhachis 2 mm. long, rather stout, flattened, plano-convex in cross section, glabrous on both surfaces, ciliate along the margins with golden brown hairs, long bearded at the expanded tips. *Sessile spikelet* ; *lower glume* 3·5–4·5 mm. long, 2·25 mm. wide, coriaceous in texture, oblong-obovate-truncate in shape, 7-nerved, the centre nerve reaching the upper margin and exserted as a minute point, the two lateral nerves on each side uniting just below the upper margin and the joint nerve on each side projects as a blunt point, glabrous but minutely

rough on the dorsal surface, golden brown to almost chestnut brown in colour with a paler band all around ; nerves anastomosing ; *upper glume* 4·5 mm. long, 2 mm. wide, 3-nerved, the two lateral nerves dividing the glume into three equal parts the centre one of which contains the median nerve, oblong-truncate, erose at the top, thin, honey coloured, scabrid on the dorsal surface in the upper half. *Lower floret* ♂ ; *lemma* hyaline, oblong-obtuse or ovate-obtuse or truncate in shape, 1-nerved ; *palea* similar, nerveless ; *stamens* 2 ; *anthers* 3 mm. long. *Upper floret* ♀ rarely ☿ ; *lemma* 3·5 mm. long, 1·5 mm. wide, 1-nerved, the nerve ending in a bristle or carried out as a small awn, obtusely 2-toothed : *palea* 2·5 mm. long, oblong-truncate, hyaline, nerveless ; *stamens* 0 rarely 2 ; *stigmas* 2·4 mm. long. *Pedicelled spikelet* : *pedicel* slender, curved, hairy with hairs up to 3 mm. long ; spikelet absent.

Ind. Or. : N.W. India, below Pauna, 18 Sept. 1850, *Royle* 357 ; Nepal, *Wallich*; 8843 8857 ; N. Bengal, Titalya, along the Mahanadi, on gravel soil, Sept. 1868, *S. Kurz* ; Bhutan, *Griffith* 2684 ; Khasi Hills, Nungklao, 1,500 m., 25 May 1886, *C. B. Clarke* 44012 ; Shillong, 1,500 m., 19 Jul. 1943, *N. L. Bor* 17988 ; Manipur State, Mayang Khong, 10 May 1882, *G. Watt* 6827.

China : Sha Po Shan, Hainan, 20 Aug. 1927, *Tsang Wai-Tak*.

8. Apocopis peguensis *Bor* in Kew Bull. **1949,** 28 (1949).

A perennial grass with thick fibrous roots. *Culms* up to 90 cm. tall, smooth and glabrous, terete, leafy almost to the panicle, bearing floriferous branches. *Leaf-blades* up to 21 cm. long, by 8 mm. wide, linear-acuminate with a prominent midrib, terminating in a stout point, covered on both surfaces with a thick mat of white, appressed, bulbous-based hairs, scabrid between the hairs, the upper blades usually rudimentary ; *leaf-sheaths* rather loose, keeled, covered in the upper part with a mat of white, appressed, bulbous-based hairs ; *ligule* 1·5 mm. long, lacerate, covered on the back with a dense mat of white hairs.

Inflorescence of two similar racemes up to 7 cm. long. *Rhachis* fragile ; *joints* 1·5 mm. long, shaped like an inverted truncated cone, somewhat compressed, garnished on the angles with stiff, chestnut-coloured hairs up to 5 mm. long, falling with the adjacent spikelet. *Spikelets* 7·25 mm. long, oblong-truncate in shape. *Sessile spikelet* hermaphrodite ; *lower glume* 6–7 mm. long by 4 mm. wide, coriaceous, chestnut-brown with a lighter coloured band above, oblong in shape, truncate above, shortly ciliate along the upper margin, long ciliate on the side margins, with cilia up to 4 mm. long on the margin adjacent to the pedicel, 7-nerved with the nerves prominent on the outer surface and anastomosing above, half-curved round the upper glume and florets in the lower quarter ; *upper glume* narrowly obovate-oblong in shape, 7·25 mm. long, divided into almost 3 equal areas by the lateral nerves ; the outer flaps rather delicate and folded around the florets, the central portion more chartaceous and containing the central nerve about which the glume is keeled, pale brown in colour, scabrid on the keel and with a few long hairs, otherwise glabrous. *Lower floret* male or neuter ; *lemma* 5·5 mm. long, oblong-ovate-truncate, 1-nerved, hyaline, ciliate on the upper margin ; *palea* a thin, narrow, hyaline oblong membrane, ciliate on the upper truncate

edge. *Upper floret* female or hermaphrodite ; *lemma* 7 mm. long, 1 mm. wide, linear in shape, 2-lobed at the apex, strongly 1-nerved, hyaline on the margins and at the base, shortly ciliate on the margins and on the lobes, the nerve being continued out as a strong twisted awn which is 3 cm. long, antrorsely scabrid on the lower twisted part and also on the short bristle ; *palea* 4 mm. long, 3 mm. wide, obovate-truncate, wrapped round the ovary, ciliate on the upper margin ; *stamens* 2 ; *anthers* 3 mm. long ; *ovary* with a style 2 mm. long, ending in two stigmas 2·5 mm. long. *Pedicelled spikelet* represented by a slender stipe 2 mm. long, bearing rusty stiff hairs up to 5 mm. long.

Burma: Pegu Division, Salu Reserve, 7 Sept. 1939, *U Thein Lwin* 59 (Type).

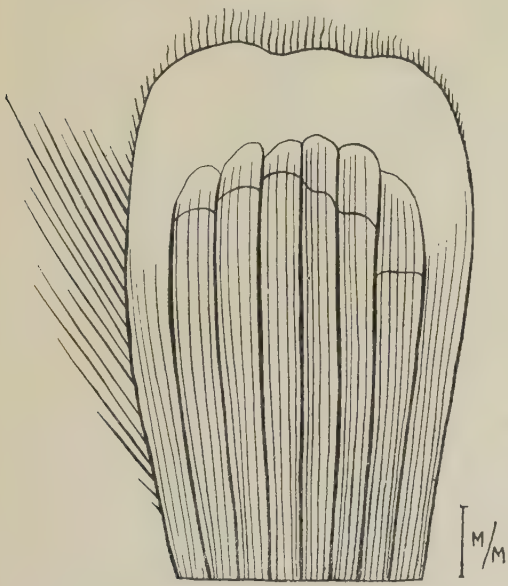

Fig. 8. Lower glume of *Apocopis peguensis* Bor.

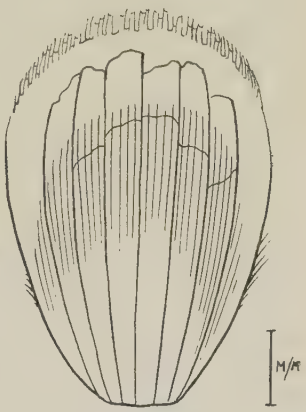

Fig. 9. Lower glume of *Apocopis collinus* Bal.

9. Apocopis collinus *Balansa* in Morot, Jour. de Bot. **4,** 84 (1890).

A. borneensis Ridley in Engl. Jahr. **44,** 519 (1910).

A perennial grass. *Culms* often crowded at the base, up to 40 cm. tall, smooth and glabrous, striatulate, erect, with blackish or dark brown nodes, 3–4 noded. *Leaf-blades* 5 cm. long, 3·5 mm. wide, linear, with long, whitish, tubercle-based hairs at the base on the upper surface, short hairs on the lower surface, tapering to an acuminate point, smooth on both surfaces, smooth on the thickened margins, or most minutely rough, almost truncate at the base, with a well-marked midrib ; *leaf-sheaths* almost keeled from the prolongation downwards of the midrib of the leaf-blade, smooth, glabrous, striate, hyaline on the margins with long tubercle-based hairs on the upper half or smooth and glabrous, covering about half the internode, somewhat loose and slipping from the culms ; *ligule* a membrane 1 mm. long, ciliate on the upper margin.

Inflorescence of 1–2 spikes seated on a long-exserted peduncle which is smooth and glabrous, slightly swollen below the raceme or racemes.

Racemes up to 4·5 cm. long, but usually only 2·5 cm. long, consisting of a fragile rhachis upon the articulations of which are seated hermaphrodite spikelets, each accompanied by a pedicel, and deciduous with the pedicel and adjoining joint of the rhachis ; joints of the rhachis 2 mm. long, somewhat flattened, ciliate on both angles with hairs 3 mm. long ; pedicel rudimentary or 1·5 mm. long, attached to the callus and base of the lower glume, furnished with long brownish hairs 4 mm. long. *Sessile spikelets* hermaphrodite except the lowest ; *lower glume* coriaceous, 5·5–6 mm. long, 3·5 mm. broad, oblong-obovate-truncate or -rounded, light brown in colour with narrow hyaline tip and margins, 7-nerved, ciliate on the upper margin, granular all over the dorsal surface, smooth and glabrous, nerves anastomosing but not percurrent to the upper margin; *upper glume* 5.5 mm. long, chartaceous, lanceolate-truncate in shape with 3 nerves, the outer flaps folded round the florets, smooth and glabrous, translucent. *Lower floret* ♂ ; lemma an ovate or lanceolate scale 5 mm. long, 2 mm. broad ; *palea* 5 mm. long, hyaline, both smooth and glabrous ; *stamens* 2 ; *anthers* 2-3 mm. long, purple ; *upper floret* ♀ ; *lemma* 4·5 mm. long, nerveless or very faintly 1-nerved ; *palea* of same texture and length ; *styles* 2, long plumose ; awn very rudimentary or absent altogether.

Borneo : North Borneo, *Burbidge* 1877–78 ; Bangar-massing, *Motley* 1857–58 ; *Martapura* 1908, *Winkler* 3392 (Type of *Apocopis borneensis* Ridley).

Siam : Nawng Han, Udawn, 200 m., 26 Feb. 1924, *Kerr* 8584.

Cochinchina : Montagne de Purset, June 1875, *Godefroy* 389 (Type).

10. Apocopis courtallumensis (*Steud.*) *Henrard* in Blumea, **4,** 524 (1941).

Andropogon courtallumensis Steud., Syn. Pl. Glum. 377 (1854).

Apocopis wightii Nees ex Thwaites, Enum. Pl. Zeyl. 365 (1864).

A perennial grass. *Culms* up to 50 cm. tall, terete, shining, smooth and glabrous, slightly striate or not, erect from the base or slightly geniculate, glabrous at the nodes. *Leaf-blades* linear-lanceolate, acuminate or acute, flat, somehat erect, imperceptibly joining the sheath, covered more or less densely on both surfaces with a mat of bulbous-based hairs, which finally fall off leaving the leaves rough on both surfaces, very scabrid on the upper surface, scabrid on the margins from the bases of bristles which are especially numerous towards the base of the blade ; midrib well marked below and carried down as a keel into the sheath ; *sheaths* markedly striate, furnished with bulbous-based hairs situated in the furrows, scarious on the margins ; *ligule* a membrane 1·5–2 mm. long.

Inflorescence a pair of racemes up to 4 cm. long, seated upon a well-exserted glabrous peduncle ; rhachis of the racemes fragile, about 2 mm. long, wider at the top, flattened, ciliate on the angles with golden brown hairs up to 2 mm. long. Spikelets sessile at the articulations of the raceme. *Lower glume* oblong-obovate, 4·5–5 mm. long, when flattened 2·5–3 mm. broad at the widest, coriaceous, 7-nerved, with the median nerve reaching the upper margin and exserted as a small point and the two intramarginal nerves almost reaching, truncate, almost 2-lobed, lacerate on the upper margin, with the nerves anastomosing at the top, coloured a rich brown or golden brown, honey coloured at the margins ;

upper glume 5 mm. long, 2·5 mm. broad, lanceolate-oblong in shape, truncate at the top, 3-nerved, the two outer flaps folded round the florets, sparsely hairy on the dorsal surface, honey-coloured, hyaline. *Lower floret* ♂ ; *lemma* a hyaline scale 4·75 mm. long, 2 mm. wide, broadly lanceolate in shape, lacerate at the tip ; *palea* a broad, oblong, hyaline scale, 4 mm. long, 2–3 mm. wide, wrapped around the 2 stamens ; anthers 2·5 mm. long. *Upper floret* ♀ ; *lemma* 4·5 mm. long, 1·5 mm. wide at the base, 2-lobed at the apex, lanceolate-oblong in shape, the sides almost parallel in the upper half, with one nerve faint below, becoming stronger and issuing from between the lobes as an awn 1·8–2 cm. long, hyaline below, chartaceous above ; *palea* 3·5 mm. long, ovate when flattened, wrapped round the stamens ; *anthers* 3·5 mm. long ; *awn* 1·8–2 cm. long ; *column* chestnut brown 8 mm. long, hairy. *Pedicel* 2·5 mm. long, slender, angled, ciliate with golden brown hairs 2 mm. long, confluent at the base with the outer margin of the lower glume of the sessile spikelet.

Ind. Or. : Madras, Devarakonda, 1,700 m., 7 Oct. 1920, *Narayanaswami* 492 ; Ganjam, Kulada, Dec. 1889, *J. S. Gamble* 21722 ; ibid. *J. S. Gamble* 21627 ; Peermade, Travancore, 16 Oct. 1916. *Venkoba Rao* 3912 ; Courtallam, Aug. 1835, *Wight* (Type). Ceylon : 1,000 m., *Thwaites*, C.P.401.

Fig. 10. Lower glume of *Apocopis courtallumensis* (Steud.) Henr.

Fig. 11. Lower glume of *Apocopis wrightii* Munro.

11. Apocopis wrightii *Munro* in Proc. Amer. Acad. Sci. **4**,363 (1860).

A tall robust perennial grass. *Culms* up to 100 cm. tall, erect, branched, covered at the base with the remains of old sheaths, smooth and glabrous, shining, quite glabrous or bearded at the nodes with white hairs. *Leaf-blades* up to 20 cm. long, 5 mm. wide, linear-acuminate, covered above and below with spaced tubercles from which long white hairs arise, diminishing in size gradually towards the tip ; *leaf-sheaths* rather loose, striate, about three quarters the length of the internode with many tubercles between the striations with long white hairs arising from them, the uppermost bearing a rudimentary leaf, keeled ; *ligule* a ciliate membrane about 1 mm. long.

Inflorescence of two racemes seated on an eventually long-exserted peduncle ; racemes 2–4·5 cm. long ; joints of the racene 1·5 mm. long, flattened, thickened upwards, ciliate with brownish hairs 3–4 mm. long ; pedicels 1·5 mm. long, furnished with hairs up to 3 mm. long. *Sessile spikelet* hermaphrodite ; *lower glume* 4·5 mm. long, 2·75 3 mm. wide,

obovate-truncate in shape, coriaceous, ciliate on the upper margin, hirsute below on the callus with brownish hairs, 7–9-nerved; none of them reaches the upper margin ; *upper glume* oblong-truncate, 4·5 mm. long, lacerate-ciliate on the upper margin, chartaceous, 3-nerved, keeled with two flaps clasping the florets, minutely scabrid on the back in the upper half ; lower floret ♂ ; *lemma* ovate-obtuse, hyaline, 4 mm. long, with some short brown hairs on the outside in the upper quarter ; *palea* a hyaline scale of the same shape but shorter, nerveless ; anthers 2, 2·5 mm. long. *Upper floret* hermaphrodite ; *lemma* linear-lanceolate, bifid at the apex, 4·5 mm. long, toothed and ciliate along the margins, with a median nerve which is carried out as a kneed awn 1·5 cm. long, whereof the lower 10 mm. constitute a twisted column, antrorsely scabrid ; *palea* 3 mm. long, hyaline, oblong-truncate, scabrid on the outside in the upper half ; *anthers* 2, 3 mm. long ; *styles* 2 ; *stigmas* 2, plumose.

China: Canton, White Cloud Hills, 11 Sept. 1878, *Sampson* 296 ; Hongkong, Lo Fan Shan, Nov. 1883, *Sampson* 134 ; in summis collibus, Aug. 1861, *Hance* 7432 ; Hongkong, Cum Sing Moon, 5 Aug. 1854, U.S. North Pacific Exploring Expedition.

Siam : Doi Sootep Chungmai, 600 m., 10 Oct. 1909, *A. F. G. Kerr* 823 " In Eng jungle" ; ibid., 11 Nov. 1911, *idem.* 2229 ; Ku Jae, about 150 km. n.w. of Kanburi, 30–50 m., 20 Jul. 1946, *A. Kostermans.*

Excluded Species.

Apocopis pallida Hook. f., Flor. Brit. Ind. 7, 143 (1896) = *Dichanthium pallidum* (Hook. f.) Stapf ex Fisch. in Gamb. Flor. Madras, 1741 (1934).

Plant Geography*—This reprint of Elizabeth Brissenden's English translation of E. V. Wulff's work on historical plant geography was published in 1950. We are told in the foreword that it covers general and theoretical problems and is the first of three projected volumes on the subject. The present volume is divided into eleven chapters, the first of which is devoted to the scope, relation to allied sciences, and methods of investigation. Other chapters deal with the history of the science ; the origin, types, centres and boundaries of areas ; parallelism, artificial and natural factors in the geographical distribution of plants ; migration of species and floras and their causes, ending with one on the concept of floral elements.

The translation has brought within the reach of all botanists and students a great deal of information of much interest. It therefore seems eminently desirable that English translations of the other parts of Dr. Wulff's valuable work should be made available as soon as possible after publication. The second part is devoted to a History of the Floras of the World, and the third and concluding part will deal with the changes in floras caused by man's activities.

The work is nicely printed and produced by the well-known Chronica Botanica Company and forms volume X of their ' New Series of Plant Science Books'.

H. S. Marshall.

*An Introduction to Historical Plant Geography. By E. V. Wulff. Authorized translation by Elizabeth Brissenden. Pp. xv + 223. (New Series of Plant Science Books, vol. 10). Waltham, Mass. : The Chronica Botanica Co. ; London, W.C.2. : Wm. Dawson and Sons, Ltd. 1950. Price $5.00.

SOUTH AFRICAN POISONOUS PLANTS.

A. A. Bullock.

The Onderstepoort Veterinary Research and Service organization is rightly acclaimed as being the finest of its kind in the world and its Journal (formerly Reports)* shows a record of solid achievement in veterinary science of which the staff is justly proud. One aspect of the work of the organization has been the patient examination of plants for their poisonous qualities—usually by direct feeding to selected stock animals—the recording of symptoms and final results; in many cases chemical assays for the isolation and identification of poisonous principles have been undertaken.

For other purposes it became necessary carefully to examine the Onderstepoort reports and journal, in the course of which a list of the plants so tested was prepared. The identification of the plants is usually acknowledged to the staff of the National Herbarium, Pretoria, where in most cases specimens are preserved.

Various full scale surveys of the poisonous and medicinal plants of South Africa have been published but for the most part the plants examined at Onderstepoort are not included in them; the references to the Reports (arabic figures) and Journal (roman figures) given below usually constitute first records of such work.

It will be observed that some plants are included twice—under their "correct" names and under well known synonyms. They are arranged alphabetically, and the main list is followed by an alphabetical list of families with the included genera.

Name	Family	Vol.	Date	Page
Acacia arabica Willd.	Leguminosae	iv	1935	407
Acacia giraffae Willd.	,,	xii	1939	356
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		iv	1935	407, 408
Acacia karoo Hayne	,,	iv	1935	408
Acacia lasiopetala Oliv.	,,	iv	1935	408
Acacia litakunensis Burch.	,,	iv	1935	409
Acacia permixta Burtt Davy	,,	iv	1935	409
Acacia saligna Wendl.	,,	vii	1936	173
Acacia spp.	,,	iv	1935	51
Acalypha indica L.	Euphorbiaceae	ix	1937	574
Acalypha punctata Meisn.	,,	17	1931	718
Acokanthera venenata G. Don	Apocynaceae	13-14	1928	208, 223
Adenia digitata (Harv.) Burtt Davy	Passifloraceae	9-10	1924	379
Adenia glauca Schinz	,,	15	1929	799
Adenia sp.	,,	15	1929	799

*These have appeared under several different titles, as follows:—

1. Reports 1–6 (1914-1919), of the Director of Veterinary Research, Union of South Africa.
2. Reports 7–14 (1920-1928), of the Director of Veterinary Education and Research, Union of South Africa.
3. Reports 15–18 (1929-1932), of the Director of Veterinary Services and Animal Industry, Union of South Africa.
4. Onderstepoort Journal, i- (1933-). Annual volumes, with a number of supplementary volumes.

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Agapanthus africanus (L.) Hoffm.	Amaryllidaceae	xx	1944	80
Agave americana L.	Agavaceae	iv	1935	399
Agrostemma githago L.	Caryophyllaceae	i	1933	226, 257
Albuca altissima Dryand.	Liliaceae	18	1932	877
Albuca fastigiata Dryand.	,,	18	1932	877
Albuca floribunda Dryand. var. fastigiata Bak.	,,	xvi	1941	137
Albuca sp.	,,	iii	1934	128
Amaranthus paniculatus L.	Amaranthaceae	xvi	1941	121
Amaryllis belladonna L. (*Sensu* Sealy)	Amaryllidaceae	17	1931	709
Anacampseros telephiastrum DC.	Portulacaceae	15	1929	799
Anthericum sp.	Liliaceae	xvii	1941	215
Araujia sericifera Brot.	Asclepiadaceae	xvi	1941	121
Arctotis stoechadifolia Berg.	Compositae	xxi	1946	48
Argemone mexicana L.	Papaveraceae	ix	1937	581
Arthrosolen gymnostachys C. A. Mey.	Thymelaeaceae	13-14	1928	233
Arthrosolen polycephalus C. A. Mey.	,,	15	1929	800
Arundo donax L.	Gramineae	17	1931	719
Asaemia axillaris (Thunb.) Harv.	Compositae	xii	1939	342
Asclepias fruticosa L.	Asclepiadaceae	17	1931	712
Asclepias physocarpa Schltr.	,,	i	1933	151
Asparagus medeoloides Thunb.	Liliaceae	15	1929	795
Aster filifolius Auct. non Vent.	Compositae	17	1931	713
		18	1932	873
		xii	1939	344
Atriplex semibracteata R. Br.	Chenopodiaceae	ix	1937	573
Avena sativa L.	Gramineae	15	1929	792
Bauhinia galpinii N. E. Br.	Leguminosae	xxi	1946	51
Berkheyopsis bechuanensis S. Moore	Compositae	xviii	1943	209
Berkheyopsis echinus Less.	,,	xviii	1943	209
Berkheyopsis pechuelli (O. Ktze.) O. Hoffm.	,,	xx	1944	75
Beta vulgaris L.	Chenopodiaceae	xvii	1941	212
		xxi	1946	47
Boophone disticha (L.f.) Herb.	Amaryllidaceae	iii	1934	125
Boscia foetida Schinz	Capparidaceae	xviii	1943	207
Bougainvillea spectabilis Willd.	Nyctaginaceae	iv	1935	411
Bulbine asphodeloides (L.) R. et S.	Liliaceae	15	1929	795
Bulbine longiscapa Willd.	,,	xv	1940	273
Bulbine sp. (near B. longiscapa)	,,	xvii	1941	215
Bulbine namaensis Schinz	,,	xv	1940	273
Bulbine narcissifolia Salm-Dyck	,,	18	1932	878
		xv	1940	273
Cadaba juncea (L.) Benth. et Hook. f.	Capparidaceae	18	1932	873
		xviii	1943	208
Canavalia ensiformis DC.	Leguminosae	17	1931	720
		15	1929	794
		ix	1937	578

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Capparis albitruncata Burch.	Capparidaceae	17	1931	713
Carica papaya L.	Passifloraceae	15	1929	781
Cassia obovata Collad.	Leguminosae	17	1931	720
		15	1929	794
Cassia occidentalis L.	,,	xxi	1946	51
Castanospermum australe A. Cunn. et Fraser	,,	xvi	1941	136
Centaurea picris DC.	Compositae	i	1933	153, 229, 257
Cephalaria sessilifolia Sond.	Dipsacaceae	iv	1935	405
Cestrum laevigatum Schltr.	Solanaceae	18	1932	884
		ii	1934	667
		iii	134	129
Chironia baccifera L.	Gentianaceae	xii	1939	350
Chironia transvaalensis Gilg	,,	i	1933	176
Chrysocoma tenuifolia Berg.	Compositae	18	1932	893
Cineraria sp.	,,	xvi	1941	122
Cissus hereroensis Schinz	Ampelidaceae	i	1933	181
Cissus juttae Gilg et Brandt	,,	vii	1936	178
Cissus quinata Ait.	,,	iv	1935	414
Cissus sp.	,,	xv	1940	275
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Clerodendron triphyllum Pearson	Verbenaceae	15	1929	801
Colocasia antiquorum Schott	Araceae	18	1932	872
Cotyledon campanulata Marl.	Crassulaceae	xii	1939	346
Cotyledon coruscans Haw.	,,	xii	1939	346
Cotyledon decussata Sims	,,	18	1932	874
Cotyledon decussata Sims	,,	xii	1939	348
Cotyledon orbiculata L.	,,	15	1929	791
Cotyledon papillaris L.f.	,,	15	1929	791
Cotyledon pillansii Schonl.	,,	17	1931	718
Cotyledon ventricosa Burm.	,,	17	1931	718
		15	1929	791
Crassula expansa Ait.	,,	ix	1937	574
Crinum sp. (near C. longifolium)	Amaryllidaceae	15	1929	780
Crotalaria allenii Verdoorn	Leguminosae	17	1931	720
Crotalaria burkeana Benth.	,,	vii	1936	173
Crotalaria distans Benth.	,,	17	1931	721
		iv	1935	409
Crotalaria dura Wood et Evans	,,	18	1932	947
		xx	1944	61
		ix	1937	119
Crotalaria globifera E. Mey.	,,	18	1932	947
		xx	1944	61
		ix	1937	120
Crotalaria nubica Benth.	,,	18	1932	876
Crotalaria rhodesiae Bak. f.	,,	xvi	1941	137
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Cryptolepis oblongifolia Schltr.	,,	xvii	1941	211
Cryptostemma calendulacea R. Br.	Compositae	xv	1940	263
Cucumis africanus L.	Cucurbitaceae	15	1929	769

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		iv	1935	65
Cussonia spicata Thunb.	Araliaceae	15	1929	778
		17	1931	712
Cynanchum africanum R. Br.	Asclepiadaceae	13-14	1928	213, 225
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Cynanchum obtusifolium L.f.	,,	xii	1939	337
Cynodon bradleyi Stent	Gramineae	15	1929	793
Cynodon plectrostachyon Pilger	,,	xvii	1941	191
Cynodon transvaalensis Burtt Davy	,,	ix	1937	577
Datura arborea L.	Solanaceae	xviii	1943	219
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		i	1933	253, 259
Datura tatula L.	,,	17	1931	725, 726
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Denekia capensis Thunb.	Compositae	vii	1936	169
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Dicrostrachys nyassana Taub.	Leguminosae	xii	1939	356
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Dimorphotheca nudicaulis DC.	,,	ix	1937	115
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Dipcadi glaucum Bak.	,,	18	1932	878
		vii	1936	175
Dipcadi viride Moench.	,,	xvii	1941	216
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Dipcadi sp. (near D. viride Moench.)	,,	xviii	1943	216
Dipcadi sp.	,,	18	1932	882
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Drosanthemum (?) hispidum (L.) Schwantes	Ficoidaceae	xii	1939	335
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Erythrina caffra Thunb.	Leguminosae	17	1931	722
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Euphorbia helioscopia L.	,,	18	1932	876
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Euphorbia mauritanica L.		18	1932	876
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Euphorbia peplus L.	,,	i	1933	246, 258
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Euphorbia sp. (near E. pubescens Vahl)	,,	xv	1940	270
Euphorbia pulvinata Marl.	,,	15	1929	792
Euphorbia rhombifolia Boiss.	,,	15	1929	792
Euphorbia truncata N. E. Br.	,,	15	1929	792
Ferraria welwitschii Bak.	Iridaceae	iv	1935	407
Foeniculum vulgare Mill.	Umbelliferae	ix	1937	123
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Geigeria zeyheri Harv.	,,	iv	1935	400
Geigeria spp.	,,	15	1929	786
Giesekia pharnaceoides L.	Ficoidaceae	iii	1934	128
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		xii	1939	364
Gnidia caffra Meisn. f. pulchra (Burtt Davy) M. Moss	,,	xviii	1943	219
Gnidia capitata L. f.	,,	15	1929	801
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		iv	1935	414
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		iv	1935	401
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Homeria pallida Bak.	Iridaceae	15	1929	793
Homeria spp.	,,	13-14	1928	195
Hyaenanche globosa Lamb	Euphorbiaceae	xvii	1941	214
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Jatropha capensis Sond.	Euphorbiaceae	xv	1940	270
Kalanchoe paniculata Harv.	Crassulaceae	xvi	1941	131
Kalanchoe rotundifolia Harv.	,,	xvii	1941	212
Kalanchoe thyrsiflora Harv.	,,	xvi	1941	134
Kedrostis nana Cogn.	Cucurbitaceae	xv	1940	267
Landolphia capensis Oliv.	Apocynaceae	xii	1939	337
Lantana camara L.	Verbenaceae	xviii	1943	197
		xxiii	1948	233
		xxiv	1949	321, 329
		xvi	1941	141
Lantana salviifolia Jacq.	,,	iv	1935	414
Lasiosiphon anthylloides Meisn.	Thymelaeaceae	13-14	1928	233
Lasiosiphon burchellii Meisn.	,,	xii	1939	364
		18	1932	888
Lasiosiphon linifolius Don	,,	13-14	1928	233
Lasiosiphon meisnerianus Endl.	,,	13-14	1928	234
Lasiosiphon kraussii Meisn.	,,	13-14	1928	234
Lathyrus sativus L.	Leguminosae	i	1933	163
Leonotis leonurus R. Br.	Labiatae	xvii	1941	214
		xv	1940	273
Lepidium draba L.	Cruciferae	i	1933	175
Lessertia physodes E. et Z.	Leguminosae	18	1932	876
Ligustrum lucidum Ait.	Oleaceae	i	1933	179
Lithospermum arvense L.	Boraginaceae	i	1933	225
Lolium temulentum L.	Gramineae	15	1929	793
		iv	1935	405
		i	1933	249, 258
Lonchocarpus capassa Rolfe	Leguminosae	15	1929	794
Lotononis calycina Benth. var. hirsutissima Dümm.	,,	vii	1936	174
Lotononis involucrata Benth.	,,	15	1929	794
Lotononis laxa E. et Z.	,,	xiii	1939	229
		xii	1939	359
Matricaria nigellifolia DC.	Compositae	9-10	1924	123
Medicago sativa L.	Leguminosae	xviii	1943	214
		xx	1944	79
		xxi	1946	51
		ix	1937	578
Melia azederach L.	Meliaceae	15	1929	796
Melianthus comosus Vahl.	Melianthaceae	15	1929	798

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Melianthus major L.	Melianthaceae	13-14	1928	216, 227
		15	1929	799
Melothria punctata Cogn.	Cucurbitaceae	13-14	1928	218, 228
Mesembryanthemum angulatum Thunb.	Ficoidaceae	xvii	1941	211
Mesembryanthemum anatomicum Harv.	,,	17	1931	707
Mesembryanthemum saxicolum N. E. Br.	,,	18	1932	871
Momordica foetida Schum. et Thonn.	Cucurbitaceae	i	1933	175
Monsonia ovata Cav.	Geraniaceae	17	1931	719
Moraea edulis Ker var. longifolia Sweet	Iridaceae	17	1931	719
Moraea polystachya Ker	,,	15	1929	793
Moraea setacea Ker	,,	15	1929	793
		xv	1940	271
Moraea simulans Bak.	,,	17	1931	720
Moraea spathacea Ker	,,	15	1929	794
		xii	1939	355
Moraea spathulata (L. f.) Klatt	,,	15	1929	794
		xii	1939	355
Moraea tristis Ker var. foliata N. E. Br.	,,	xxi	1946	50
Moraea viscaria Ker	,,	17	1931	720
Moraea spp.	,,	13-14	1928	195
Myristica fragrans Houtt.	Myristicaceae	ix	1937	121
Narcissus jonquilla L.	Amaryllidaceae	17	1931	711
Nemesia capensis O. Ktze.	Scrophulariaceae	18	1932	883
Neorautanenia coriacea C. A. Sm.	Leguminosae	17	1931	722
Nerine lucida Herb.	Amaryllidaceae	17	1931	711
Nerine sp. (near N. marginata)	,,	15	1929	779
Nerium oleander L.	Apocynaceae	15	1929	778
Nicandra physaloides Gaertn.	Solanaceae	i	1933	180
Nicotiana glauca R. Grah.	,,	18	1932	884
		i	1933	180
		xxiv	1949	301
Nidorella anomala Steetz	Compositae	15	1929	788
Nidorella resedifolia DC.	,,	15	1929	788
Noltea africana Reichb. f.	Rhamnaceae	xii	1939	361
Ochna pulchra Hook.	Ochnaceae	17	1931	724
Opuntia decumana (Willd.) Haw.	Cactaceae	15	1929	780
Opuntia sp.	,,	xv	1940	263
Ornithogalum aurantiacum Bak.	Liliaceae	15	1929	795
Ornithogalum calcicola *nom. nud.*	,,	ix	1937	120
Ornithogalum caudatum Ait.	,,	i	1933	178
		15	1929	795
		ix	1937	121
Ornithogalum ecklonii Fisch. et Mey.	,,	15	1929	795
Ornithogalum lacteum Jacq.	,,	i	1933	178
		15	1929	795
Ornithogalum longibracteatum Jacq.	,,	iv	1935	410
Ornithogalum pretoriense Bak.	,,	vii	1936	176
		ix	1937	580
		xxi	1946	52

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Ornithogalum subulatum Bak.	,,	xv	1940	274
Ornithogalum tenellum Jacq.	,,	13-14	1928	219, 228
Ornithogalum thyrsoides Jacq.	,,	xvii	1941	216
Ornithoglossum glaucum Salisb.	,,	17	1931	722, 723
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Othonna cluytiifolia O. Ktze.	Compositae	xviii	1943	210
Othonna pallens DC.	,,	iv	1935	401
		ix	1937	115
		xviii	1943	212
Oxalis smithii Sond.	Oxalidaceae	vii	1936	177
Pachystigma pygmaea (Schltr.) Robyns	Rubiaceae	9-10	1924	9
		17	1931	725
		xvii	1941	219
Papaver aculeatum Thunb.	Papaveraceae	xxi	1946	54
Paspalum distichum L.	Gramineae	xv	1940	271
		iv	1935	405
Peddiea africana Harv.	Thymelaeaceae	15	1929	801
Pentanisia variabilis Harv.	Rubiaceae	iv	1935	412
Pentarrhinum insipidum E. Mey.	Asclepiadaceae	xx	1944	75
		xii	1939	339
Pentzia globifera Hutch.	Compositae	15	1929	788
Pergularia gariepensis N. E. Br.	Asclepiadaceae	ix	1937	113
Pergularia sp.	,,	xii	1939	339
Phaseolus vulgaris L.	Leguminosae	xviii	1943	214
		xxi	1946	52
Physalis minima L.	Solanaceae	i	1933	180
		15	1929	800
Phytolacca dioica L.	Phytolaccaceae	iv	1935	411
Platycarpha glomerata Less.	Compositae	xviii	1943	213
Poinciana pulcherrima L.	Leguminosae	xvii	1941	214
Pseudogaltonia clavata (Bak.) Phillips	Liliaceae	xvi	1941	139
Psilocaulon absimile N. E. Br.	Ficoidaceae	i	1933	439
Pteronia pallens L.f.	Compositae	15	1929	788
Pygmaeothamnus chamaeodendron (O. Ktze.) Robyns	Rubiaceae	i	1933	179
Pyrethrum spp.	Compositae	vii	1936	171
Ranunculus pubescens Thunb.	Ranunculaceae	15	1929	800
Raphanus raphanistrum L.	Cruciferae	i	1933	244, 258
Relhania trinervia Thunb.	Compositae	xx	1944	76
Ricinus communis L.	Euphorbiaceae	15	1929	792
		i	1933	246, 258
Royena decidua Burch.	Ebenaceae	xx	1944	77
		xxi	1946	50
Royena lucida L.	,,	15	1929	791
Royena pallens Thunb.	,,	xx	1944	77
		xxi	1946	50
Rumex acetosella L.	Polygonaceae	xv	1940	274
		i	1933	253, 259
Rumex ecklonianus Meisn.	,,	ix	1937	581
Rumex nepalensis Spreng.	,,	17	1931	724
Ruschia saxicola (N. E. Br.) L. Bol.	Ficoidaceae	18	1932	871
Salacia rehmanii Schinz	Hippocrateaceae	ix	1937	119

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Salsola kali E. Mey.	Chenopodiaceae	15	1929	781
Sarcostemma viminale R. Br.	Asclepiadaceae	17	1931	712
		xii	1939	339
		ix	1937	114
Sceletium anatomicum (Haw.) L. Bol.	Ficoidaceae	17	1931	707
Schizocarpus nervosus (Burch.) F. van der Merwe	Liliaceae	xxi	1946	52
Schistostephium crataegifolium Fenzl	Compositae	15	1929	788
Scilla cooperi Hook.	Liliaceae	15	1929	796
Scilla inquinata C. A. Sm.	,,	xxi	1946	54
Scilla lancifolia Bak.	,,	18	1932	882
Scilla natalensis Planch.	,,	xviii	1943	217
Scilla ovatifolia Bak.	,,	xvii	1941	217
		vii	1936	176
Scilla rigidifolia Kunth	,,	15	1929	796
		xx	1944	81
		xxi	1946	52
Scilla sp. (near S. cooperi)	,,	i	1933	177
Scilla sp.	,,	i	1933	179
Senecio adnatus DC.	Compositae	xv	1940	251
Senecio albanensis Harv.	,,	i	1933	173
Senecio angustifolia Willd.	,,	15	1929	789
Senecio arenarius Thunb.	,,	i	1933	230
Senecio bupleuroides DC.	,,	17	1931	715
		xxiv	1949	291
		vii	1936	172
Senecio burchellii DC.	,,	i	1933	230, 257
		vii	1936	172
Senecio fremontii Torr. et Gray	,,	15	1929	789
Senecio glaberrimus DC.	,,	iv	1935	402
Senecio glutinosus Thunb.	,,	17	1931	715
		xxi	1946	48
		ix	1937	116
Senecio ilicifolius Thunb.	,,	xv	1940	241
		i	1933	233, 257
Senecio isatideus DC.	,,	17	1931	715
		xx	1944	76
		xiv	1940	433
		xii	1939	155
		i	1933	239, 258
Senecio laevigatus Thunb.	,,	ix	1937	117
Senecio latifolius DC.	,,	15	1929	789
Senecio othonniflorus DC.	,,	17	1931	716
Senecio paucicalyculatus Klatt	,,	xxiv	1949	297
Senecio pinnulatus Thunb.	,,	17	1931	718
Senecio pterophorus DC.	,,	xvi	1941	122
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Senecio sp.	,,	xii	1939	345
		ix	1937	117
		iv	1935	404
Sida rhombifolia L.	Tiliaceae	17	1931	723
Silene gallica L.	Caryophyllaceae	i	1933	228
Solanum auriculatum Ait.	Solanaceae	i	1933	180
Solanum capsicastrum Link ex Schauer	,,	15	1929	800
Solanum coccineum Jacq. (*sensu Fl. Cap.*)	,,	xii	1939	362
Solanum giganteum Jacq.	,,	xii	1939	363
		iv	1935	413
Solanum incanum L.	,,	18	1932	885
		17	1931	726
Solanum macroscolum Fern.	,,	xv	1940	274
Solanum nigrum L.	,,	18	1932	886
Solanum panduriforme E. Mey.	,,	18	1932	886, 887
Solanum quadrangulare Thunb.	,,	xv	1940	275
Solanum rigescens Jacq.	,,	18	1932	888
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Solanum tomentosum L. (*sensu Fl. Cap.*)	,,	xii	1939	363
Solanum tuberosum L.	,,	17	1931	726
		xxi	1946	54
Sorghum saccharatum Pers.	Gramineae	vii	1936	172
Sorghum sudanense Stapf	,,	iv	1935	406
Sorghum vulgare Pers.	,,	ix	1937	577
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Stizolobium deeringianum Bort	,,	15	1929	794
Stizolobium pruriens Medic.	,,	15	1929	794
Strychnos henningsii Gilg	Loganiaceae	15	1929	796
Strychnos mitis S. Moore	,,	15	1929	796
Sueada fruticosa Forssk.	Chenopodiaceae	15	1929	782
Synadenium arborescens Boiss.	Euphorbiaceae	xii	1939	350
Tagetes minuta L.	Compositae	15	1929	790
		xvi	1941	131
Talinum caffrum E. et Z.	Portulacaceae	i	1933	179
Teedia pubescens Burch.	Scrophulariaceae	xii	1939	362
Tephrosia macropoda E. Mey.	Leguminosae	ix	1937	579
Tephrosia vogelii Hook.	,,	iv	1935	410
		ix	1937	579
Tetragonia schenckii Schinz	Ficoidaceae	xxi	1946	46
Thesium lineatum L.	Santalaceae	xii	1939	362
		xviii	1943	218
Thesium namaquense Schltr.	,,	xv	1940	275
		iv	1935	412
Thesium triflorum Thunb.	,,	vii	1936	177
		ix	1937	122
Toxicodendron capense Thunb.	Euphorbiaceae	xvii	1941	214
Tribulus terrestris L.	Zygophyllaceae	15	1929	765
		16	1930	413

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Trichocaulon piliferum (L.f.) N. E. Br.	Asclepiadaceae	iii	1934	125
Tulbaghia acutiloba Harv.	Amaryllidaceae	vii	1936	176
Urginea altissima (L.f.) Bak.	Liliaceae	18	1932	882
		iv	1935	410
		vii	1936	177
Urginea burkei Bak.	,,	15	1929	796
		iv	1935	417
Urginea capitata Bak.	,,	ii	1934	681
Urginea macrocentra Bak.	,,	11-12	1926	303
		xviii	1943	217
Urginea rubella Bak.	,,	xxiv	1949	313
		xvii	1941	217
Urginea sp.	,,	xii	1939	359, 361
		ix	1937	580
Vangueria pygmaea Schltr.	Rubiaceae	17	1931	725
		9-10	1924	9
		xvii	1941	219
Vallota purpurea Herb.	Amaryllidaceae	15	1929	778
Verbena bonariensis L.	Verbenaceae	ix	1937	123
Vicia sativa L.	Leguminosae	i	1933	251, 259
Vigna hirta Hook.	,,	xx	1944	80
Vigna vexillata A. Rich.	,,	15	1929	795
Vinca major L.	Apocynaceae	18	1932	871
		xxi	1946	45
Withania somnifera Dunal	Solanaceae	i	1933	181
Zygophyllum foetidum Schrad.	Zygophyllaceae	17	1931	726
		iii	1934	129
Zygophyllum microcarpum Lichst.	,,	15	1929	801
		ix	1937	123
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- Tribulus
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NOTES ON ASIATIC GRASSES : III.

New Names in Poa Linn.

N. L. Bor.

Poa asperifolia *Bor* sp. nov., *P. pratensi* Linn. comparanda sed ab ea foliorum laminis scaberrimis, ligulis multo longioribus, lemmatis dorso basi sparse puberulo, lana nulla facile distinguenda.

Gramen perenne, rhizomatosum. *Culmi* usque 50 cm. alti, erecti vel basi paullo decumbentes, glaberrimi, laeves, 4-nodes. *Foliorum laminae* usque 12 cm. longae, 2·5 mm. latae, utrinque scaberrimae praecipue apicem versus, lineares, marginibus scabrae, in apicem validum attenuatae, planae vel complicatae. *Vaginae* nodis longiores, culmum complectentes vel inferne laxae et a culmo solutae, laeves, glabrae, striatae. *Ligulae* membranaceae, 3–6 mm. longae, oblongo-obtusae.

Panicula usque 15 cm. longa ; rami inferiores usque 10 cm. longi, flexuosi, ramosi, paucispiculati, scabri rarius laeves ; rami inferiores 2–5-nati, inferne 2–3 cm. nudi. *Spiculae* oblongo-ellipticae, 5–5·5 mm. longae, 3-florae, saepe purpurascentes, fulvescentes. *Gluma inferior* 2·5–3 mm. longa, 1 mm. lata, explanata oblongo-acuta, a latere visa acuminata, marginibus anguste hyalina, 1-nervis, laevis, glabra, carina superne scaberula ; *gluma superior* 3·5–3·75 mm. longa, 2 mm. lata, elliptico-oblongo-acuta, 3-nervis, marginibus anguste hyalina, laevis glabraque, carina superne scaberula. *Lemma* 3·5–4 mm. longum, 2 mm. latum, elliptico-oblongum vel obovatum, acutum, 5-nerve, apice brevissime et marginibus anguste hyalinum, nervis lateralibus carinaque basi ciliatum, basin versus inter nervos brevissime pilosum, ceterum laeve glabrumque. *Lana* abest. *Rhachilla* laevis vel verrucosa. *Antherae* 1·5–1·7 mm. longae. *Palea* lemmati brevior, anguste elliptico-oblonga, carinis scabra.

Tibet : Pembu La, 10-15 miles north of Lhasa, Sept. 1904, *H. J. Walton* s.n. (Typus in Herb. Kew.) ; Gautsa, 4,000 m., 16 May, 1945, *Bor et Kiratram* 20359.

This striking species resembles *P. pratensis* Linn. in a number of respects, particularly in the possession of a rhizome, but the absence of wool at the base of the lemmas and the long ligules in this species, separate them at once. An additional difference is the silky covering of the lower part of the dorsal surface of the lemma.

Poa sikkimenensis Bor, stat. nov.

P. annua Linn. var. *sikkimensis* Stapf in Hook. f., Flor. Brit. Ind. **7,** 346 (1896).

Ind. Or. : Sikkim; Wallanchoon, 3-4.000 m., *J. D. Hooker* (typus in Herb. Kew.) ; Phusum, 3,000 m., 25 Jun. 1945, *Bor et Kiratram* 19936 and several other collections in Sikkim. Lahul, Jispa, 3,000 m., 16 Jul. 1941, *N. L. Bor* 16403.

Tibet : Yatung, 3,000 m., 18 Jun. 1945, *Bor et Kiratram* 20312 and several other collections in Tibet.

This species is an annual or subperennial, with firmly chartaceous lemmas, a 3-nerved lower glume and the keels of the palea semipilose. These characteristics separate it from *P. annua* Linn. which, although allied, is quite different. It has not so far been collected in India outside Sikkim except for one specimen collected in Lahul.

NOTES ON TROPICAL WEST AFRICAN SPECIES OF COMBRETUM : II.

R. W. J. Keay

Combretum excelsum *Keay*, sp. nov. ; affinis *C. tomentoso* G. Don et *C. pecoensi* Exell, sed receptaculo superiore sparse tomentoso, foliis multo majoribus, inflorescentiis multo longioribus, ramulis, petiolis et foliis subtus glandulosis et breviter puberulis, fructibus ut videtur multo majoribus ; et ab *C. tomentoso* G. Don foliis basi cordatis apice acuminatis differt.

Frutex scandens, grandis, usque 30 m. altus. *Ramuli* juveniles dense vel sparse puberuli et glandulosi. *Folia* opposita vel ternata, pro rata brevissime petiolata, petiolo dense vel sparse puberulo et glanduloso 5–10 mm. longo ; lamina oblonga, basi alte cordata vel auriculata, apice manifeste acuminata, 8–28 cm. longa 5–12·5 cm. lata, coriacea, utrinque nitidula primum puberula deinde glabrescens, subtus glandulosa ; margine integra leviter undulata ; costa nervique supra impressi, subtus valde prominentes ; nervi laterales utrinque 10–13 arcuatim adscendentes vix anastomosantes ; rete venularum subtus prominens nervis secundariis subparallelis. *Flores* tetrameri in spicas elongatas axillares paniculatas dispositi ; paniculae ingentes, usque 2 m. longae ; spicae 12–20 cm. longae ubique tomentosae, pedunculis 3–5 cm. longis, bracteolis subulatis c. 2 mm. longis. *Receptaculum inferius* 2–2·5 mm. longum quam superius longius dense tomentosum ; *superius* subpatelliforme c. 2 mm. longum, 3–3·5 mm. latum, extra sparse tomentosum, intus pilosum, disco crassiusculo glabro ; segmenta calycis late triangularia. *Petala* late rhomboidea vel suborbicularia, extra pilosa, 1·5 mm. longa et lata. *Stamina* 8, quam petala breviora, haud exserta, filamentis c. 1 mm. longis. *Stylus* glaber, staminia aequans. *Fructus* quadrialatus ambitu ellipticus, 3·7–5·1 cm. longus, 3·0–3·8 cm. latus, alis quam corpus duplo latioribus chartaceis ferrugineo-brunneis sparse tomentellis, corpore dense ferrugineo-tomentello inter alis costato.

Nigeria. Ogoja Province, Ikom District, Cross River North Forest Reserve, about 22 km. east of Ikom, margin of high forest, 7 Dec. 1950, *Keay in For. Herb. Ibadan* 28147 (typus in Hb. Kew.) :—liane, to 30 m. high. Flowers in very large panicles ; calyx pale yellow ; anthers yellow included. Fruits collected from same plant a few months later.

In my previous notes (Kew Bull. **1950**, 248 : 1950) *C. tomentosum* G. Don was cited as the only West African species of § *Tomentosae*. Mr. Exell has described (Journ. Bot. **66** Suppl. 1 : 165 : 1926) a second species of this section, *C. pecoense* from Peco in the Portuguese Congo. *C. excelsum* is apparently only the third known species of this very distinct section of the genus. The three species are fairly widely separated geographically : *C. tomentosum* is known from Senegal, French Guinea, French Sudan and Sierra Leone, *C. excelsum* from Ikom in south-eastern Nigeria near the borders of the British Cameroons, and *C. pecoense* several hundred miles further south in Portuguese Congo. The three species may be distinguished by the following key :

Leaves rounded at the base, truncate to very slightly acuminate at the apex, densely tomentose below . . *tomentosa* G. Don

Leaves deeply cordate to auriculate at the base, distinctly acuminate, pubescent to glabrescent below :

Young shoots, petioles and midribs long pilose, leaves 4–8 cm. long, 2–4 cm. broad, 7–9 pairs of lateral nerves, secondary nerves not prominent ; spikes 6–12 cm. long (including peduncle), upper receptacle densely tomentose . . . . . *pecoense* Exell

Young shoots, petioles and midribs shortly pubescent, leaves 8–28 cm. long, 5–12·5 cm. broad, 10–13 pairs of lateral nerves, secondary nerves very prominent ; spikes 15–25 cm. long (including peduncle), upper receptacle sparsely tomentose . . . . . *excelsum* Keay

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A.E.T.F.A.T. CONFERENCE, BRUSSELS.

24–27th Oct. 1951.

The first plenary Conference of l'Association pour l'Étude Taxonomique de la Flore de l'Afrique Tropicale (A.E.T.F.A.T.) was held, on the invitation of Prof. P. Duvigneaud, at l'Institut Botanique de l'Université de Bruxelles, 24th–27th October, 1951. Prof. Dr. L. Hauman kindly consented to preside throughout the session. More than thirty members and visitors attended.

The private business of A.E.T.F.A.T. occupied the first three mornings of the conference and members had an opportunity to discuss the organization, finances and future activities of the Association. The four afternoons and evenings were devoted to a programme of illustrated lectures dealing with the vegetation of the greater part of Tropical Africa and Madagascar ; speakers included M. Barzin, Recteur de l'Université de Bruxelles, M. M. V. Homès, Directeur de l'Institut Botanique Leo Errera, Dr. A. Aubreville, Prof. P. Duvigneaud. Mr. A. W. Exell, Prof. C. Favarger, Prof. H. Humbert, Mr. A. C. Hoyle, Dr. F. R. Irvine, M. H. Jacques-Felix, Mr. R. W. J. Keay, Dr. J. Léonard, Mr. R. D. Meikle, Dr. F. A. Mendonça, Mr. E. Milne-Redhead, Dr. R. Schnell and Dr. H. Scott.

In addition to these meetings, the delegates and visitors were hospitably received by M. F. Jurion, Directeur General de l'Institut National pour l'Étude Agronomique du Congo Belge (I.N.E.A.C.) and by M. R. Bouillenne, President de la Commission Scientifique de Biologie Vegetale de l'Institut pour la Recherche Scientifique en Afrique Centrale (I.R.S.A.C.) who described the activities of their respective Institutes in organizing and assisting biological research in Tropical Africa.

On Saturday morning, 27th October, members enjoyed the privilege of seeing the beautiful grounds of the Château de Lembeck through the kind invitation of the owner, M. Brien.

The Conference closed with a dinner given jointly by the English, French and Portuguese delegates, after which tribute was paid to the generous hospitality extended by their Belgian colleagues and to the energy they had shown in organizing a very successful conference.

NOTES ON AFRICAN OLEACEAE

W. B. Turrill.

1. On the Genus Jasminium in East Africa.

Jasminum is the largest genus of *Oleaceae* in East Africa, with 20 accepted species at the present date in Uganda, Kenya, Tanganyika, and Zanzibar. Several of the species have a wide range both within and outside these countries. Others, however, are, so far as is known, very restricted in range. Taxonomically, the genus is a difficult one and there are bound to be differences of opinion as to where specific limits can best be drawn. Material in herbaria is still too scanty, and some of that which is available has not been well collected, for final determination of character correlations. Some of the problems met with in preparing an account of the *Oleaceae* for the Flora of Tropical East Africa can only be solved satisfactorily when population studies by modern taxonomic methods have been carried out. The incomplete field data available suggest that some species are highly plastic, responding to different habitat conditions, such as those of high forest or bush or open savanna, with considerable structural changes in habit, leaf size and shape, and degree of development of indumentum. On the other hand, there is no experimental evidence available for distinguishing such ecads from ecotypes with distinct genoms. This difficulty has been particularly acute in the studies made for the Flora on the genus *Jasminum*. In some " groups " correlation of characters breaks down so widely that species have had to be taken in a very broad sense, as, for example, in *J. fluminense* Vell. More intensive field investigations may show the need for still further reducing the number of so-called species. Every taxon has to be judged on its own merits and the degree of inter-taxic breeding varies from one extreme to another in genera where it has been carefully studied. There is no reason to suppose that *Jasminum* is exceptional in this respect. One may, therefore, expect both very variable species with subspecies and varieties that tend to cross frequently and others with little variation and with no or rare gene exchanges outside a narrow morphological or taxonomic range. It is hoped that the tentative classification of the *Oleaceae* to be published in the Flora of Tropical East Africa will stimulate residents in the countries concerned to undertake detailed studies of variation within the genera of this family, and especially of the genus *Jasminum*.

It has been found necessary to make some changes of taxonomic status in *Jasminum* requiring special comment and a few nomenclatural changes. For the convenience of taxonomists these have been brought together for publication in this paper.

Jasminum fluminense *Vell.* Fl. Flumin. 10 (1825) ; op. cit. Atl. **1,** t. 23 (1827) subsp. **nairobiense** *Turrill* subsp. nov. a subsp. *fluminense* foliis saepissime minoribus glabrescentibus plus minusve nitentibus apice rotundatis praecipue distinguitur.

Kenya. Nairobi District, a large shrub, more or less scandent, from Nairobi, 1680 m., *E. Battiscombe* 448 (type, in Herb. Kew.) ; common around Nairobi and Ngong District, scandent shrub, slender, very sweetly scented, usually not more than 2 or 3 feet in height, *E. R. Napier* 326 ; Karura, bushes on fringe of forest, climber, flowers white, corolla

tube tinged with green, 1610 m., 10.12.1930, *E. R. Napier* 567 ; bushland, Nairobio utskirts, flowers white, fragrant, Feb. 1915, 1635 m., *Dümmer* 2028.

Two specimens probably best placed in this subsp. but linking on to subsp. *fluminense* by some of the leaves being larger and acute or subacute are : Nairobi, 1650 m., *W. J. Dowson* 361 ; and Nairobi, a large shrub more or less scandent, 1680 m., *E. Battiscombe* 447.

Jasminum fluminense *Vell.* It is unfortunate that this widely ranging tropical African species was first described from Tropical America, as shown by Dandy in K.B. 1950, 368. No type specimen has been seen, and possibly none exists, but the type locality is given as " silvis maritimis Regii Praedii Sanctae Crucis ". The original description and figure are not entirely satisfactory ; they have been interpreted as carefully as possible.

Within the area of the Flora of Tropical East Africa a number of plants have been named as species which come into the complex of *J. fluminense* if this be accepted in a fairly broad sense—and it must be unless one allows for a very large number of interspecific variants. Until extensive and detailed field work has been done on this complex no more than a tentative scheme of classification of the numerous phenotypes can be attempted. To bring the nomenclature into line with the International Rules the following combinations are here made :

J. fluminense *Vell.* Fl. Flumin. 10 (1825) ; op, cit. Atl. **1,** t. 23 (1827).
subsp. **fluminense**
var. **fluminense**
var. **blandum** (*S. Moore*) *Turrill* comb. nov.
syn. *J. blandum* S. Moore in J.L.S. **37,** 179 (1905).
subsp. **nairobiense** *Turrill* subsp. nov. (vide supra).
subsp. **mauritianum** (*Boj.*) *Turrill* comb. nov.
syn. *J. mauritianum* Boj. ex DC. Prodr. **8,** 310 (1844).
subsp. **holstii** (*Gilg*) *Turrill* comb. nov.
syn. *J. holstii* Gilg in P.O.A.C., 309 (1895).

J. meyeri-johannis *Engl.* and **J. oleicarpum** (**oleaecarpum**) *Baker.*

There were five gatherings from Kirk placed under the species *J. oleicarpum* Baker in K.B. 1895, 95, in the Herbarium at Kew. These are : 1. Tette, Nov. 1858 ; 2. Opposite Senna, Jan. 1859 ; 3. Tette, Feb. 1859 ; 4. Rovuma, 30 miles up, 28.3.1861 ; and 5. Kilwa (with no date of collecting). Nos. 1 to 4 are apparently all referred to by Baker in the original publication of the species and from then the type has to be chosen. No. 4 has shortly pubescent leaf-blades and is, therefore, rejected as the type since Baker says " follis . . . . . glabris ". Nos. 1 to 3 all have the young branches pubescent not glabrous, " ramulis glabris ", as described by Baker, though they are glabrescent and then glabrous with age. No. 3, Tette, Febr. 1859, is here chosen as the type, since it is in fruit and the species is presumably named because of the superficial resemblance of the fruit to an olive fruit. With No. 3 can readily be associated No. 1 in flower. Having determined a type specimen for *J. oleicarpum* there remains the problem of the botanical status of the supposed species. There is at Kew a fine series of specimens now named *J. meyeri-johannis* Engl. Hochgebirgsflora Trop. Afr. 334 (1891). The

type of this species is given as " Kilimandscharo, im Marangu von 1300–1500 m., *Meyer* 371", and has presumably been destroyed at Berlin-Dahlem. The material of *J. oleicarpum* agrees so closely with the original description and with the named material of *J. meyeri-johannis* that it has not been possible to find strong reasons for keeping the two supposed taxa specifically distinct. In *J. oleicarpum*, as accepted by Baker, the leaves are smaller on the whole and the corolla tubes slightly shorter than in the material determined, *e descriptione*, as *J. meyeri-johannis*. There is, however, an overlap in the measurements.

Jasminum grahamii *Turrill* sp. nov. a *J. stenolobo* Rolfe foliis haud conspicue articulatis, calycis lobis brevioribus distinguitur.

Frutex scandens, 9 dm. altus ; ramis junioribus dense albo-pilosis, deinde glabrescentibus, medulla cubiculata. *Folia* spiralia rarissime subopposita vel opposita, simplicia ; lamina elliptica vel rotundata, apice obtusa vel rotundata, interdum leviter emarginata, basi late cuneata, 3–10 mm. longa, 3–6·5 mm. lata, utrinque dense breviterque pubescentia, costa nervisque utrinque vix conspicuis ; petiolus 0·5–1 mm. longus, dense albo-pilosus. *Flores* solitarii (? an semper), ramis brevioribus plus minusve terminales ; pedicellus 1·5–3 mm. longus, glaber vel fere ad basem leviter pilosus ; bracteae lineares, acutae, circiter 2 mm. longae. *Calyx* glaber vel fere glaber, lobis plus minusve pilosulis exceptis ; tubus subcampanulatus, 3 mm. longus ; lobi 5, lineari-subulati, acuti, 2–2·5 mm. longi. *Corolla* alba, odorata ; alabastra acuta ; tubus 2·6 cm. longus, tenuis, basi 1·5 mm. diametro, fauce 4 mm. diametro ; lobi 7–9, lingulati subacuti vel obtusi, 1·1 cm. longi, 2·5–3 mm. lati. *Stamina* 1·8 cm. supra basem corollae tubi inserta ; antherae dehiscentes lineares, 4 mm. longae, acutae ; filamenta vix 1 mm. longa. *Ovarium* 1·25 mm. longum, 1 mm. diametro ; stylus gracillimus, cum stigmate 2·5 cm. longus.

Kenya. Kwale District, Mackinnon Road, 1929, growing in bush land, *R. M. Graham* 1658. (Type in the Kew Herbarium ; isotype in the East African Herbarium, Nairobi).

This species of *Jasminum* has several characters unusual in the section (*Unifoliata*) to which it belongs. The collector records it as " scandent ", but, judging from the material seen, it would appear to scramble or sprawl rather than to climb. There are numerous short, rather stiff branches that arise from branches of a lower order at right angles or nearly so. Some of these branches give the appearance of being almost spinescent. The leaves are, at anthesis, small, though of various sizes, and have very short petioles that are not conspicuously articulated. The leaves are nearly all spirally arranged as are the branches that arise singly in their axils. The pith of these branches is, at least as they become older, very clearly chambered.

2. A New Species of Schrebera.

Schrebera greenwayi *Turrill* sp. nov. ; a *S. mazoense* S. Moore foliolis fere glabris, calyce majore differt ; a *S. alata* Hochst. foliolis minoribus, ramis junioribus densissime puberulis distinguitur.

Frutex ramossimus, usque ad 3 m. altus ; rami juniores densissime breviterque puberuli deinde glabrescentes. *Folia* pinnata, opposita, saepissime 8–10·5 cm. longa ; foliola 5, obovata, anguste obovata, vel anguste elliptica, apice rotundata vel plus minusve acuta, basi cuneata,

saepissime 2·1–5 cm. longa et 1–2·5 cm. lata, costa nervisque pagina abaxiale praecipue conspicuis, nervis lateralibus principalibus utrinque 5–7 marginem versus anastomosantibus, glabra vel ima basi leviter puberula, sessilia vel fere sessilia ; petiolus alatus, basi plus minusve auriculatus, 1·8–2·8 cm. longus ; rhachis alata, 2·1–2·6 cm. longa. *Inflorescentia* compacta, foliis brevior, ramis terminalis, 4–6-flora ; pedunculus 1–1·5 cm. longus, densissime puberulus ; bracteae ovatae usque ad anguste ellipticae, acutae, 3–6 mm. longae ; pedicelli 1–2 mm. longi. *Calyx* breviter cylindricus, 6 mm. longus, 3–3·5 mm. diametro, margine irregulariter acute dentatus, leviter puberulus vel fere glaber. *Corolla* viridi-flavescens ; tubus cylindricus, 7 mm. longus, fauce 3 mm. diametro ; lobi oblongo-rotundati, 3·5–4 mm. longi, 3 mm. lati, basi dense barbati. *Stamina* corollae fauci affixa ; antherae breviter exsertae, 2·5 mm. longae. *Ovarium* 1·5 mm. altum, 1·5 mm. diametro ; stylus cum stigmate 6·5 mm. longus.

TANGANYIKA. Mbulu District, Gendabi, western slopes of Mt. Hanang, 2250 m., 10 Febr. 1946, *P. J. Greenaway* 7688 (Type in Herb. Kew. isotype in East African Herbarium, Nairobi).

" Not very common with *Tinnea aethiopica*, *Allophylus* sp. G. 7732 in *Calodendrum capense*, *Croton scheffleri*, *Albizzia brachycalyx*, *Apodytes dimidiata Euclea* spp., *Scolopia theifolia* bushland in a rocky mountain gorge in a reddish orange loam of volcanic origin on the foot-slopes of the mountain ".

Wild Flower Studies.*—From the number of popular books dealing with plants of the British flora published since the war one would judge that the public is becoming more botanically minded. The fault of many of the books intended to serve as aids in naming plants found in the wild is that they are so incomplete. It must be very exasperating to a beginner again and again to wade through a book on wild flowers only to end by realizing that the plant he is trying to determine is not there figured or described. However, an incomplete introduction to the study of our flora may be better than none and the beginner using a book like that here noticed may be induced by its gaps to purchase and use a more complete flora.

There is, of course, no doubt that figures, and especially coloured ones, aid speedy determination of living flowering specimens. The coloured figures in this book are often charming and some are reasonably accurate in colour reproduction. There are, however, some that are spoilt by the colours as printed. The red on yellow in the petals of the Yellow Horned Poppy is entirely misleading. The red of the Musk Thistle and the mauve of the campanulas are simply wrong. The descriptions are mostly accurate and likely to be useful but the statement that the Sea Campion has the flowers " all borne separately " is frequently untrue. The black and white drawings deserve considerable praise.

Apart from the above criticism of some of the flower colours, the book is exceedingly well reproduced. W. B. TURRILL.

*B. D. Inglis, Wild Flower Studies, Thomas Nelson & Sons Ltd., Edinburgh, 28th February, 1952, 25s. With 44 coloured plates and 102 pages of text figures, descriptions and index.